MITSUBISHI ELECTRIC

<TRANSISTOR ARRAY>

# M63840FP

## 8-UNIT 500mA DARLINGTON TRANSISTOR ARRAY WITH CLAMP DIODE SOURCE TYPE

### DESCRIPTION

M63840FP are eight-circuit output-sourcing Darlington transistor array. 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 (BVCEO ≥ 40V)
- High-current driving (Io(max) = –500mA)
- With clamping diodes
- Wide operating temperature range (Ta= -40 ~ +85℃)
- Driving available with PMOS IC output of 6 ~ 16V or with TTL output
- Output current-sourcing type

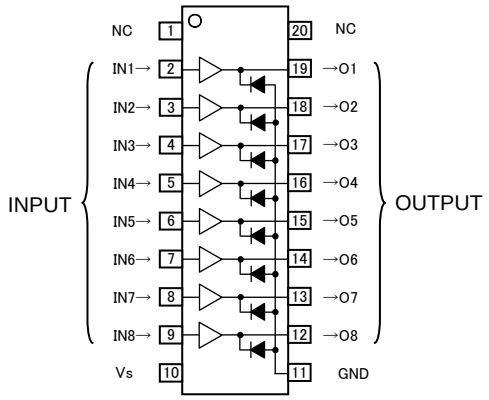
### APPLICATIONS

Drives of relays, printers, LEDs, fluorescent display tubes and lamps, and interfaces between MOS-bipolar logic systems and relays, solenoids, or small motors.

### FUNCTION

The M63840FP each have eight circuits, which are made of input inverters and current-sourcing outputs.
The outputs are made of PNP transistors and NPN Darlington transistors. The PNP transistor base current is constant. A clamping diode is provided between each output and GND. VS and GND are used commonly among the eight circuits.
The inputs have resistance of 10kΩ, and voltage of up to 15V is applicable. Output current is 500 mA maximum. Supply voltage VS is 50V maximum.

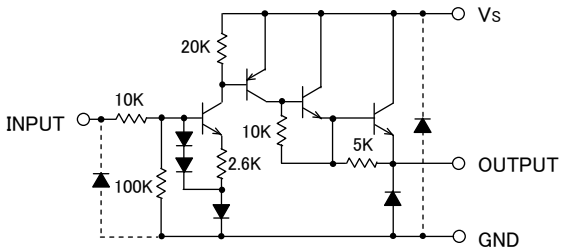
### PIN CONFIGURATION




Package type 20P2N-A

NC : No connection

### CIRCUIT DIAGRAM




The eight circuits share the VS and GND.

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

Unit :Ω

**ABSOLUTE MAXIMUM RATINGS** (Unless otherwise noted, Ta = –40 ~ +85° C)

| Symbol | Parameter | Conditions | Ratings | Unit |
|---|---|---|---|---|
| $V_{CEO}$ # | Collector-emitter voltage | Output , L | −0.5 ～ +40 | V |
| $V_S$ | Supply voltage | | 40 | V |
| $V_I$ | Input voltage | | −0.5 ～ +15 | V |
| $I_O$ | Output current | Current per circuit output, H | −500 | mA |
| $I_F$ | Clamping diode forward current | | −500 | mA |
| $V_R$ # | Clamping diode reverse voltage | | 40 | V |
| Pd | Power dissipation | Ta = 25℃, when mounted on board | 1.10 | W |
| Topr | Operating temperature | | −40 ～ +85 | ℃ |
| Tstg | Storage temperature | | −55 ～ +125 | ℃ |

# : Unused Input pins must be connected to GND.

**RECOMMENDED OPERATING** (Unless otherwise noted, Ta = –40 ~ +85℃)

| Symbol | Parameter | | Limits | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| $V_S$ | Supply voltage | | 0 | — | 40 | V |
| $I_O$ | Output current (Current per 1 circuit when 8 circuits are coming on simultaneously) | Duty Cycle no more than 5% | 0 | — | −350 | mA |
| | | Duty Cycle no more than 30% | 0 | — | −100 | |
| $V_{IH}$ | "H" input voltage | | 2.0 | — | 12 | V |
| $V_{IL}$ | "L" input voltage | | 0 | — | 0.8 | V |

**ELECTRICAL CHARACTERISTICS** (Unless otherwise noted, Ta = 25℃)

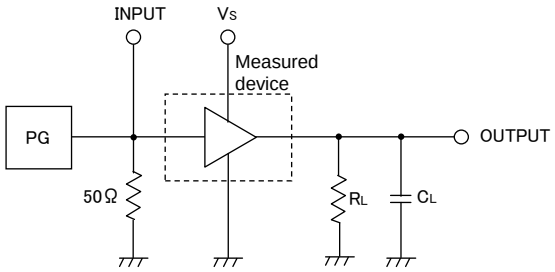
| Symbol | Parameter | Test conditions | Limits | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| $I_{S(leak)}$ # | Supply leak current | $V_S$ = 40V, $V_I$ = 0.8V | — | — | 100 | μA |
| $V_{CE(sat)}$ | Collector-emitter saturation voltage | $V_S$ = 10V, $V_I$ = 2.0V, $I_O$ = −350mA | — | 1.7 | 2.0 | V |
| | | $V_S$ = 10V, $V_I$ = 2.0V, $I_O$ = −100mA | — | 1.5 | 2.0 | |
| $I_I$ | Input current | $V_I$ = 2.4V | — | 36 | 52 | μA |
| | | $V_I$ = 3.85V | — | 180 | 5.0 | |
| $I_S$ | Supply current | $V_S$ = 40V, $V_I$ = 2V (all input) | — | — | 2.5 | mA |
| $V_F$ # | Clamping diode forward voltage | $I_F$ = −350mA | — | −1.3 | −2.0 | V |
| $I_R$ | Clamping diode reverse current | $V_R$ = 40V | — | — | 100 | μA |

# : Unused Input pins must be connected to GND.

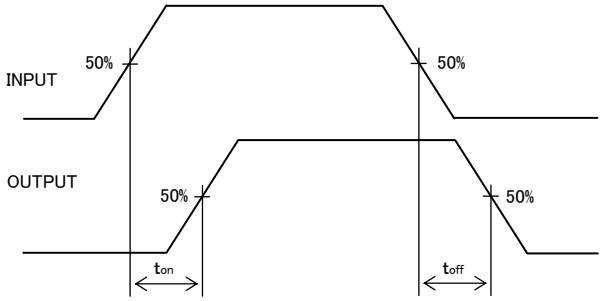
**SWITCHING CHARACTERISTICS** (Unless otherwise noted, Ta = 25℃ )

| Symbol | Parameter | Test conditions | Limits | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| ton | Turn-on time | $C_L$ = 15pF (note 1) | — | 210 | — | ns |
| toff | Turn-off time | | — | 2200 | — | ns |

**NOTE 1 TEST CIRCUIT**



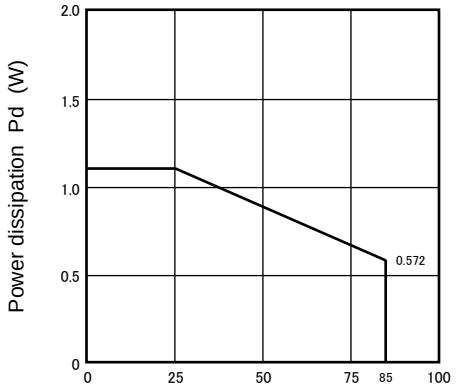

**TIMING DIAGRAM**



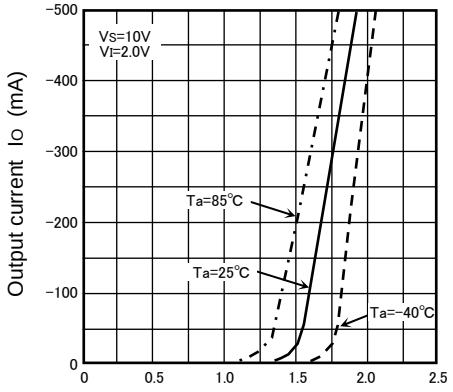

(1) Pulse generator (PG) characteristics: PRR = 1kHz, tw = 10ms, tr = 6ns, tf = 6ns, $Z_O$ = 50Ω, $V_I$ = 0 to 2V
(2) Input-output conditions : $R_L$ = 30Ω, $V_S$ = 10V
(3) Electrostatic capacity CL includes floating capacitance at connections and input capacitance at probes

## TYPICAL CHARACTERISTICS

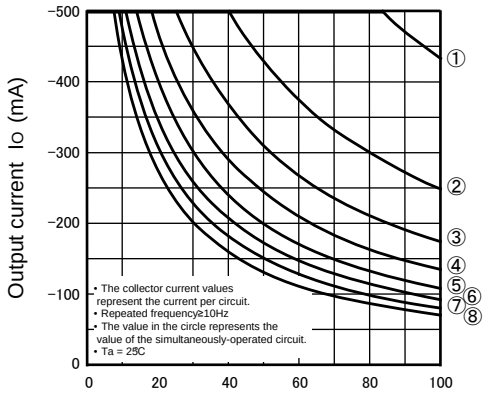
### Thermal Derating Factor Characteristics



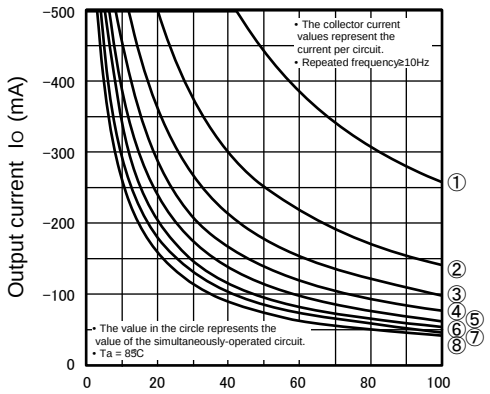

### Output Saturation Voltage Collector Current Characteristics



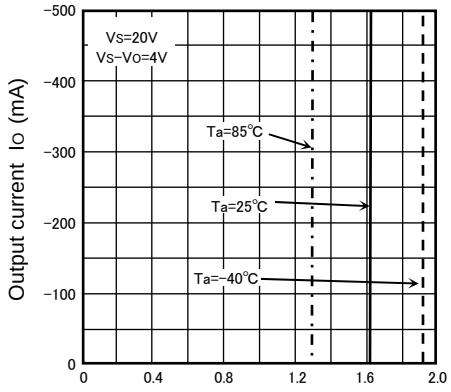

### Duty-Cycle-Output current Characteristics



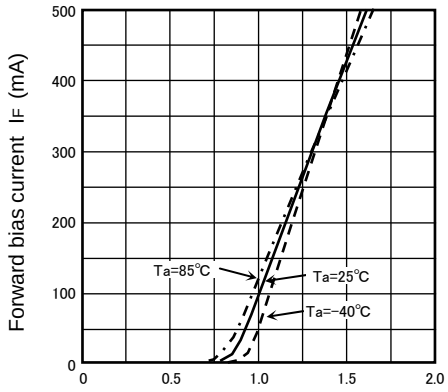

### Duty-Cycle-Output current Characteristics



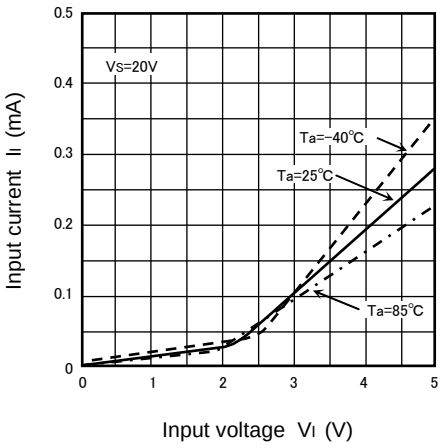

### Grounded Emitter Transfer Characteristics



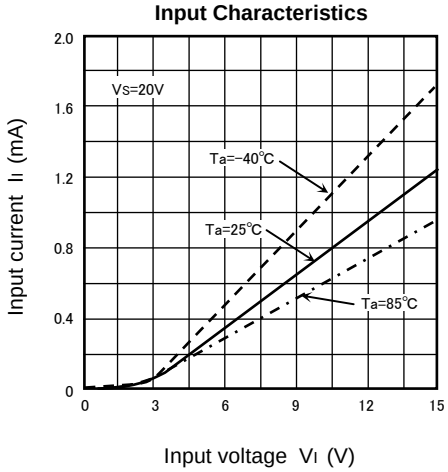

### Clamping Diode Characteristics



**Input Characteristics**



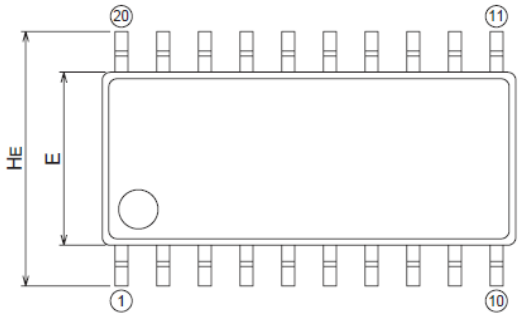

**Input Characteristics**

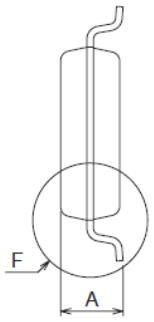


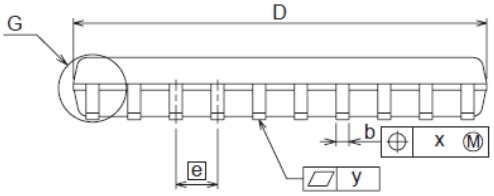
**PACKAGE OUTLINE**

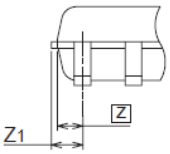
**20P2N-A** — **Plastic 20pin 300mil SOP**

| JEITA Package Code | JEDEC Code | Weight(g) | Lead Material |
|---|---|---|---|
| P-SOP20-5.3x12.6-1.27 | – | 0.26 | Cu Alloy |

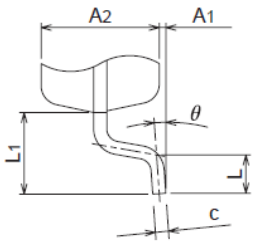


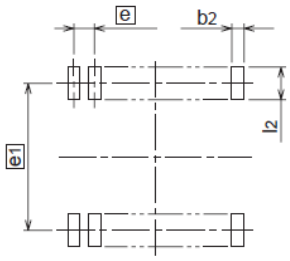




Detail G




Detail F




Recommended Mount Pad

| Symbol | Dimension in Millimeters | | |
|---|---|---|---|
| | Min | Nom | Max |
| A | – | – | 2.1 |
| A1 | 0 | 0.1 | 0.2 |
| A2 | – | 1.8 | – |
| b | 0.35 | 0.4 | 0.5 |
| c | 0.18 | 0.2 | 0.25 |
| D | 12.5 | 12.6 | 12.7 |
| E | 5.2 | 5.3 | 5.4 |
| e | – | 1.27 | – |
| HE | 7.5 | 7.8 | 8.1 |
| L | 0.4 | 0.6 | 0.8 |
| L1 | – | 1.25 | – |
| Z | – | 0.585 | – |
| Z1 | – | – | 0.735 |
| x | – | – | 0.25 |
| y | – | – | 0.1 |
| θ | 0° | – | 8° |
| b2 | – | 0.76 | – |
| e1 | – | 7.62 | – |
| l2 | 1.27 | – | – |

## Keep safety first in your circuit designs!

Mitsubishi Electric Corporation puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage. Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of non-flammable material or (iii) prevention against any malfunction or mishap.

## Notes regarding these materials

- These materials are intended as a reference to assist our customers in the selection of the Mitsubishi semiconductor product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Mitsubishi Electric Corporation or a third party.
- Mitsubishi Electric Corporation assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
- All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Mitsubishi Electric Corporation without notice due to product improvements or other reasons. It is therefore recommended that customers contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor for the latest product information before purchasing a product listed herein.
  The information described here may contain technical inaccuracies or typographical errors. Mitsubishi Electric Corporation assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.
  Please also pay attention to information published by Mitsubishi Electric Corporation by various means, including the Mitsubishi Semiconductor home page (http://www.MitsubishiElectric.com/).
- When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Mitsubishi Electric Corporation assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
- Mitsubishi Electric Corporation semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
- The prior written approval of Mitsubishi Electric Corporation is necessary to reprint or reproduce in whole or in part these materials.
- If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.
  Any diversion or re-export contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
- Please contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor for further details on these materials or the products contained therein.