

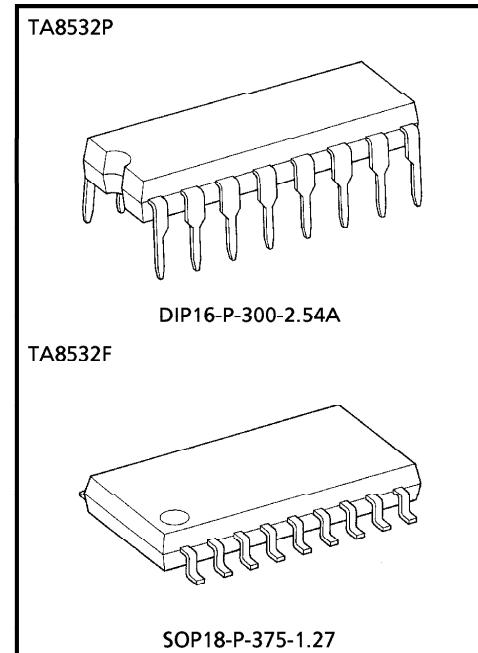
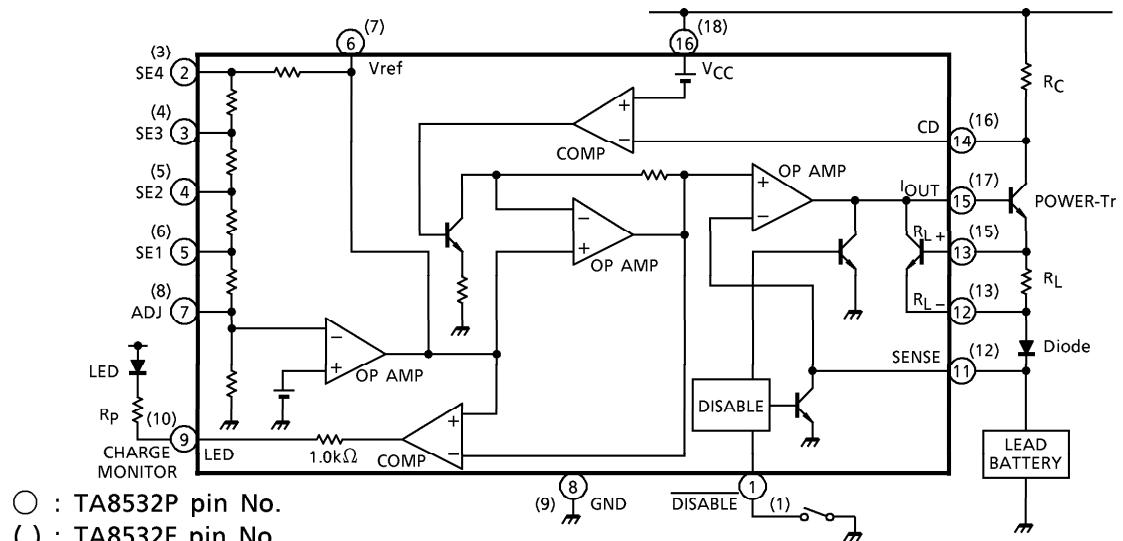
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA8532P, TA8532F**BATTERY CHARGER IC**

TA8532P, TA8532F is Battery Charger IC for Lead Batteries and applicable to various types from 1 to 6cells. Simple system with minimized external components is available.

FEATURES

- Applicable to various types of lead battery from 1 to 6 cells utilizing selectable reference voltage.
- Reference voltage can be adjusted by external resistor.
- Charging time can be set freely by changing the external current (charging current) with the external resistor.
- Charging completion can be indicated by LED utilizing the charge monitor circuit.
- This device can be disabled externally.
- Battery discharge at power off can be protected by the reverse current protection system.

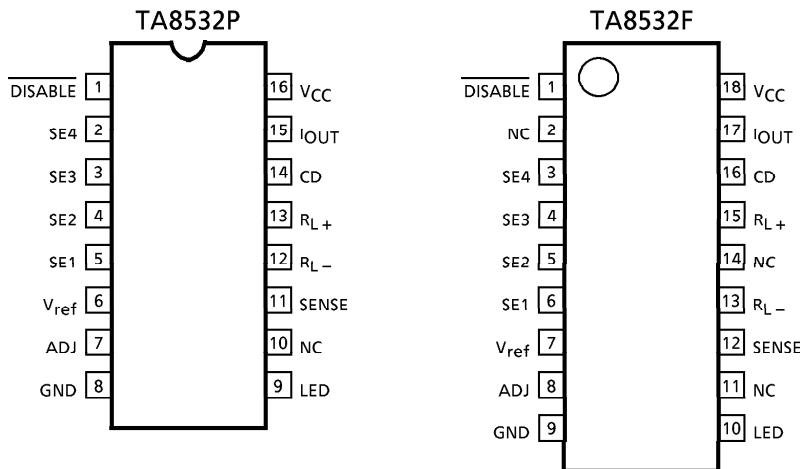
SYSTEM BLOCK DIAGRAM

Weight DIP16-P-300-2.54A : 1.0g (Typ.)
SOP18-P-375-1.27 : 0.5g (Typ.)

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PIN CONNECTION (TOP VIEW)



PIN FUNCTION

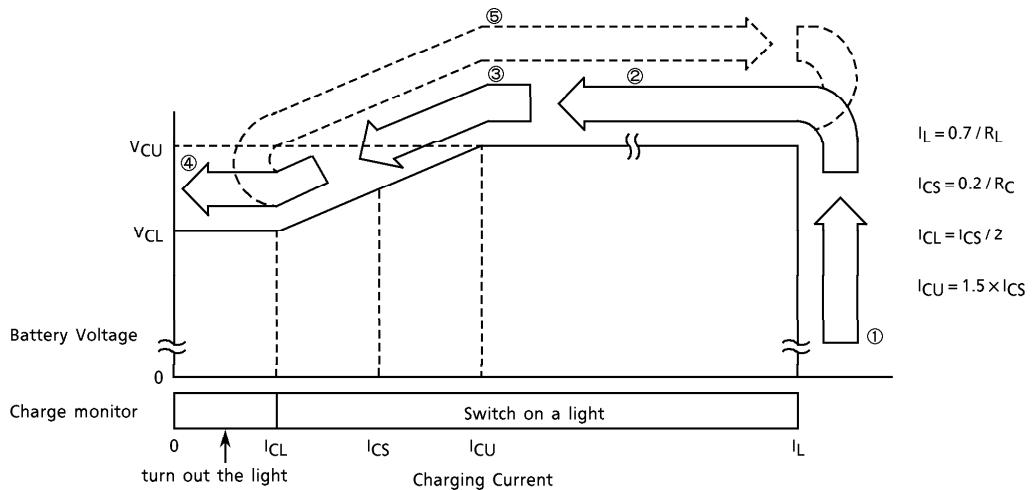
| PIN No. | PIN NAME | FUNCTION |
|---------|------------------|---|
| 1 (1) | DISABLE | To stop charging by L input. |
| 2 (3) | SE4 | Selection terminal for 5cells connecting with Vref terminal. |
| 3 (4) | SE3 | Selection terminal for 4cells connecting with Vref terminal. |
| 4 (5) | SE2 | Selection terminal for 3cells connecting with Vref terminal. |
| 5 (6) | SE1 | Selection terminal for 2cells connecting with Vref terminal. |
| 6 (7) | Vref | Standard Voltage Terminal. |
| 7 (8) | ADJ | To adjust the Vref terminal output. And 1cell is selected connecting with Vref terminal through a variable resistor. |
| 8 (9) | GND | Ground |
| 9 (10) | LED | For the LED indication during the charging (Output current>I _{CL}). |
| 11 (12) | SENSE | To sense the battery output voltage. |
| 12 (13) | R _L - | For connection with the current the limiting resistance. The limiting current is given (0.7/R _L). |
| 13 (15) | R _L + | The current limiting resistor is connected between R _L . |
| 14 (16) | CD | Connecting terminal for the current sense resistor and Power transistor. The resistor is to be connected to the internal current sense circuit and makes the slope $\Delta V_C / \Delta I_C$. It is also connected to the charge monitor circuit and control lighting LED. |
| 15 (17) | I _{OUT} | The charging current output terminal. The emitter of Power transistor to be connected. |
| 16 (18) | V _{CC} | Power Supply Voltage Terminal. |

() : TA8532F pin No.

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- The information contained herein is subject to change without notice.

CHARGING PROCESS CHART



| | |
|----------|--|
| I_L | Determined by the external resistor R_L . |
| I_{CS} | Determined by the external resistor R_C . |
| I_{CL} | Almost the center between I_{CS} and I_{CU} . |
| I_{CU} | Almost triple of I_{CL} . |
| V_{CU} | Charging Voltage. Dependent on the number of the battery cells. Refer to the chart in the next page. |
| V_{CL} | Fouging Voltage. Dependent on the number of the battery cells. Refer to the chart in the next page. |

OPERATION

- (1) As shown in the above chart, charging starts with maximum current I_L (given by the formula $0.7 / R_L$) and the battery voltage increases gradually.
- (2) When the battery voltage reaches V_{CU} (Charging Voltage), the voltage is fixed at V_{CU} , that is the constant voltage charging state. And the charging current decreases gradually.
- (3) When the charging current decreases to the point of I_{CU} , the voltage starts dropping. The voltage dropping continues until the current reaches I_{CL} , and is settled at the Focusing Voltage (V_{CL}). And the voltage dropping ratio is given by the formula $(V_{CU} - V_{CL}) / (I_{CU} - I_{CL})$ and it's center is V_{CS} and I_{CS} .
- (4) The center of the voltage dropping curve is I_{CS} , which is given by the formula $0.2 (R_C : \text{External Resistor})$.
- (5) LED indicates as a charging monitor during the charging current is greater than I_{CL} . When it becomes lower than I_{CL} , LED turns off for the indication of charging completion. Internal resistance is $1\text{k}\Omega$ and external resistor is needed at $V_{CC} \geq 15\text{V}$.

MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

| CHARACTERISTIC | | SYMBOL | RATING | UNIT |
|-------------------------------|---------|-----------|----------------|------------------|
| Supply Voltage | | V_{CC} | 24 | V |
| Max. Pre-drive Output Current | | I_{out} | 20 | mA |
| Power Dissipation | TA8532P | P_D | 1 | W |
| | TA8532F | | 0.9 | |
| Operating Temperature | | T_{opr} | $-30 \sim 75$ | $^\circ\text{C}$ |
| Storage Temperature | | T_{stg} | $-55 \sim 150$ | $^\circ\text{C}$ |

RECOMMENDED OPERATING CONDITION

| CHARACTERISTIC | | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|----------------------|---------------|----------|------|------|------|------|
| Power Supply Voltage | 1Cell Charge | V_{CC} | 9 | — | 20 | V |
| | 2Cells Charge | | 9 | — | 20 | |
| | 3Cells Charge | | 11 | — | 20 | |
| | 4Cells Charge | | 13.5 | — | 20 | |
| | 5Cells Charge | | 16 | — | 20 | |
| | 6Cells Charge | | 18.5 | — | 20 | |

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, $V_{CC} = 9 \sim 20\text{V}$, $T_a = 25^\circ\text{C}$)

| CHARACTERISTIC | | SYMBOL | TEST CIR-CUIT | TEST CONDITION | | MIN. | TYP. | MAX. | UNIT |
|---------------------------------------|---|-----------------|---------------|---|--|------|------|------|---------------|
| Power Supply Current | I_{CC} | 1 | | $V_{CC} = 9\text{V}$ | | — | 6.7 | — | mA |
| | | | | $V_{CC} = 20\text{V}$ | | — | 7.0 | 10 | |
| Output Current | I_{out} | 2 | | — | | 20 | 40 | — | mA |
| LED Output Current | I_{LED} | 3 | | $V_{CC} = 20\text{V}$, $V_{LED} = 7\text{V}$ | | — | 6.0 | — | mA |
| | | | | $V_{CC} = 20\text{V}$, $V_{LED} = 18\text{V}$ | | 10 | 16 | — | |
| Limiter Output Detection Voltage | V_{Lim} | 4 | | — | | — | 0.7 | — | V |
| Voltage Switching Detection Voltage | V_C | 5 | | — | | — | 0.2 | — | V |
| Non-adjustment Focusing Voltage Error | 2Cells Charge 3Cells Charge 4Cells Charge 5Cells Charge 6Cells Charge | ΔV_{CL} | — | $V_{CC} = 20\text{V}$, $V_{CL} = 4.550\text{V}$ | | -8 | — | 8 | % |
| | | | | $V_{CC} = 20\text{V}$, $V_{CL} = 6.825\text{V}$ | | -8 | — | 8 | |
| | | | | $V_{CC} = 20\text{V}$, $V_{CL} = 9.100\text{V}$ | | -8 | — | 8 | |
| | | | | $V_{CC} = 20\text{V}$, $V_{CL} = 11.375\text{V}$ | | -8 | — | 8 | |
| | | | | $V_{CC} = 20\text{V}$, $V_{CL} = 13.650\text{V}$ | | -8 | — | 8 | |
| Non-adjustment Charging Voltage Error | 2Cells Charge 3Cells Charge 4Cells Charge 5Cells Charge 6Cells Charge | ΔV_{CU} | — | $V_{CC} = 20\text{V}$, $V_{CU} = 4.90\text{V}$ | | -10 | — | 10 | % |
| | | | | $V_{CC} = 20\text{V}$, $V_{CU} = 7.35\text{V}$ | | -10 | — | 10 | |
| | | | | $V_{CC} = 20\text{V}$, $V_{CU} = 9.80\text{V}$ | | -10 | — | 10 | |
| | | | | $V_{CC} = 20\text{V}$, $V_{CU} = 12.25\text{V}$ | | -10 | — | 10 | |
| | | | | $V_{CC} = 20\text{V}$, $V_{CU} = 14.70\text{V}$ | | -10 | — | 10 | |
| Output Voltage Adjustment Width | A_{ra} | — | | — | | -10 | — | 10 | % |
| SENSE Terminal Reverse Current | I_{rev} | 6 | | — | | — | 0.1 | 10 | μA |
| Disable Terminal "H" Voltage | $V_{DIS\ H}$ | — | | — | | 2.0 | — | — | V |
| Disable Terminal "L" Voltage | $V_{DIS\ L}$ | — | | — | | — | — | 0.8 | V |

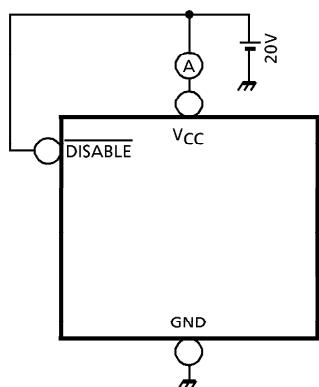
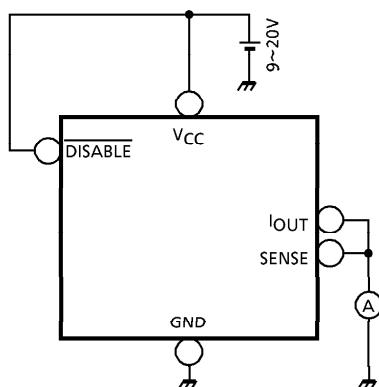
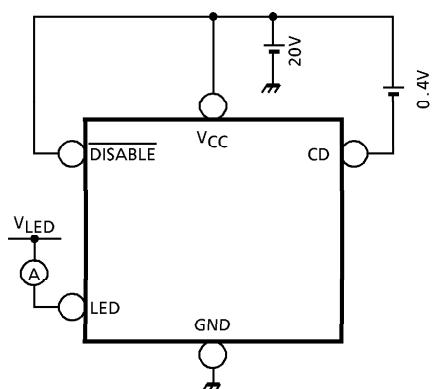
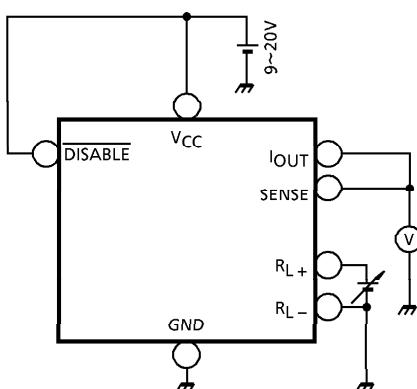
STANDARD VOLTAGE ADJUSTMENT

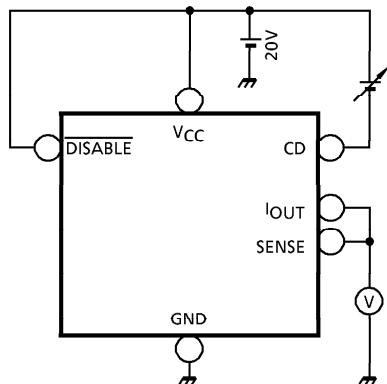
| NUMBER | V _{CL} (V) | V _{CU} (V) | V _{ref} TERMINAL CONECTION |
|--------|---------------------|---------------------|-------------------------------------|
| 1Cell | 2.275 ± 0.025 | 2.45 ± 0.07 | V _{ref} -ADJ |
| 2Cells | 4.550 ± 0.050 | 4.90 ± 0.14 | V _{ref} -SE1, ADJ |
| 3Cells | 6.825 ± 0.075 | 7.35 ± 0.21 | V _{ref} -SE2, ADJ |
| 4Cells | 9.100 ± 0.100 | 9.80 ± 0.28 | V _{ref} -SE3, ADJ |
| 5Cells | 11.375 ± 0.125 | 12.25 ± 0.35 | V _{ref} -SE4, ADJ |
| 6Cells | 13.650 ± 0.150 | 14.70 ± 0.42 | V _{ref} OPEN, ADJ |

(Note 1) The ADJ terminal is to be connected through valuable resistor and controlled.

(Note 2) Adjustment is to be done in accordance with the above focusing voltage.

TEST CIRCUIT

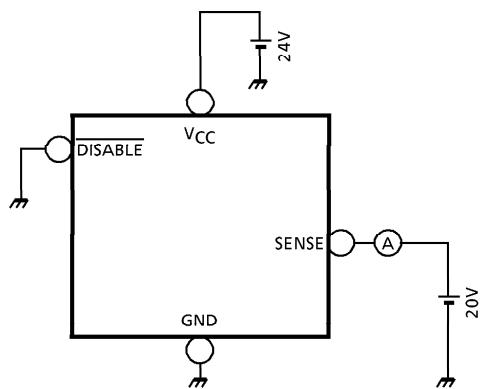
(1) I_{CC}(2) I_{OUT}(3) I_{LED}(4) V_{Lim}

(5) V_C 

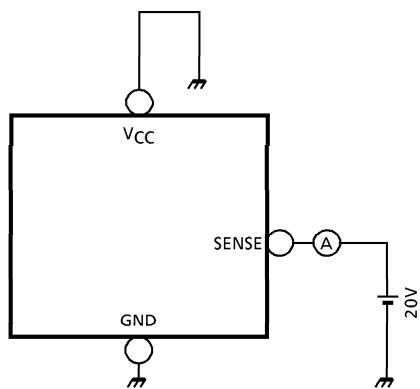
- V_{CC-CD}
 $V_{CH} : 0.4V$
 $V_{CL} : 0V$

(6) I_{rev}

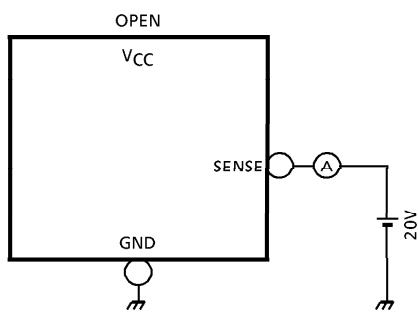
- $V_{CC} = 24V$



- $V_{CC} = GND$

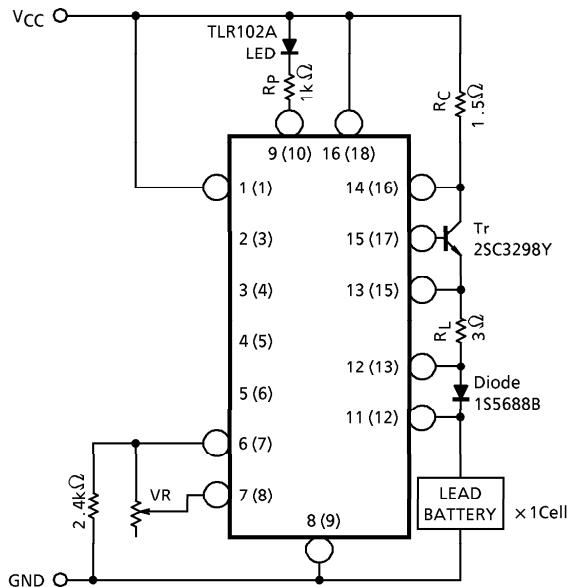


- $V_{CC} = OPEN$

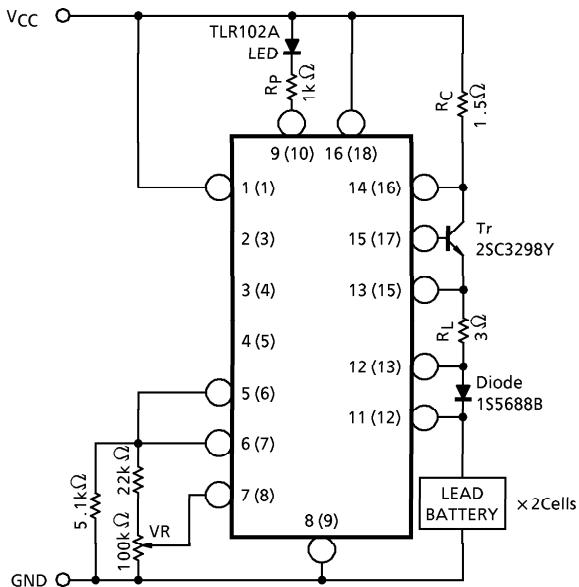


APPLICATION

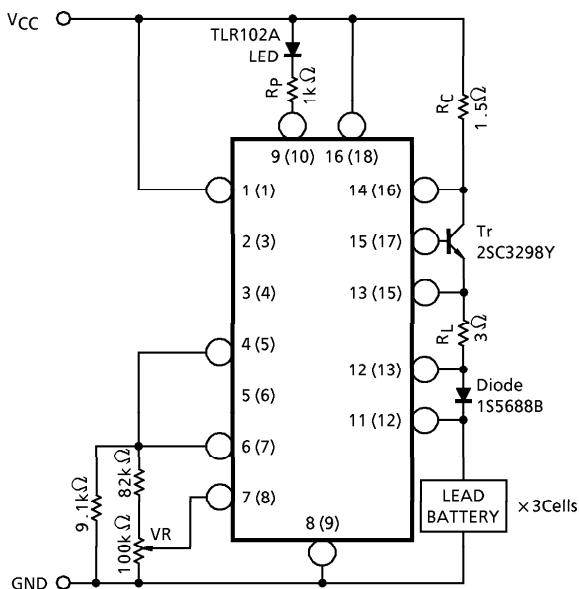
(1) 1Cell



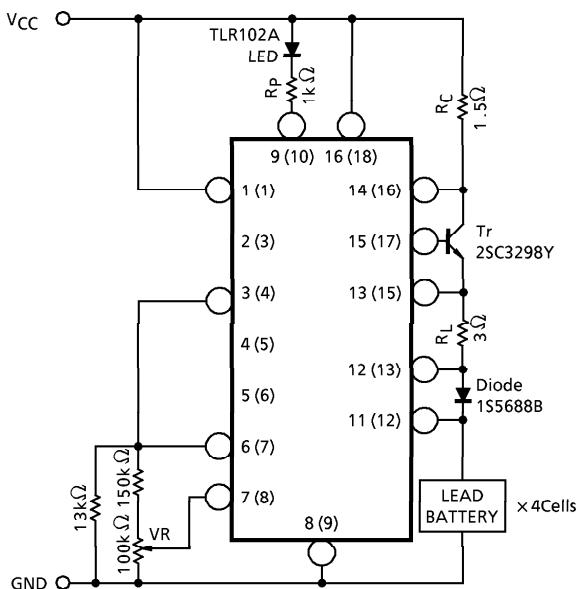
(2) 2Cells



(3) 3Cells

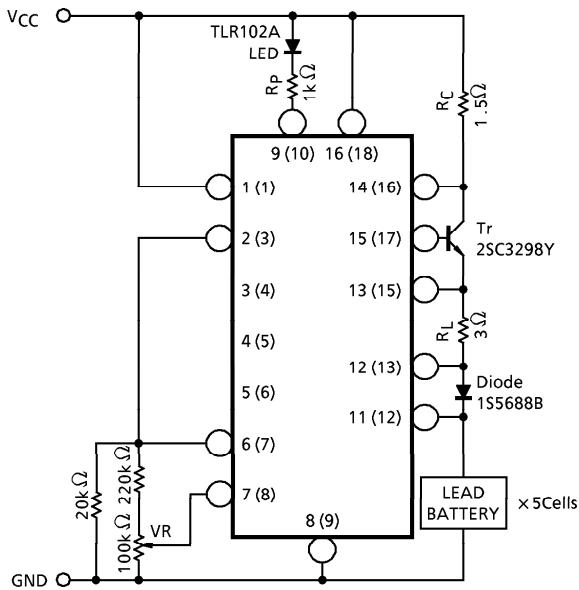


(4) 4Cells

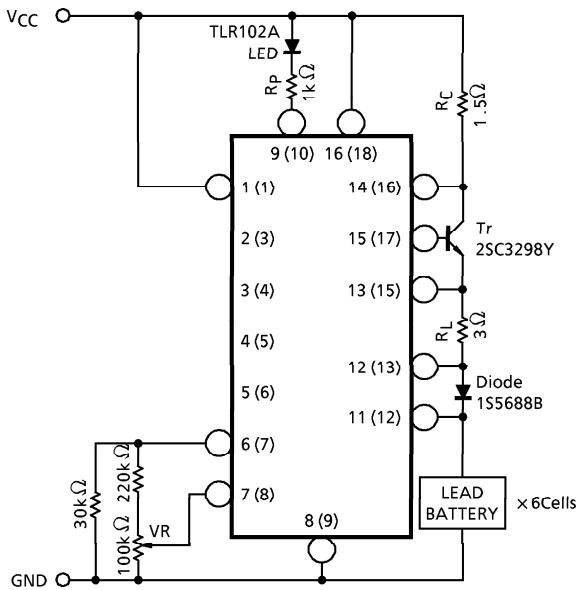


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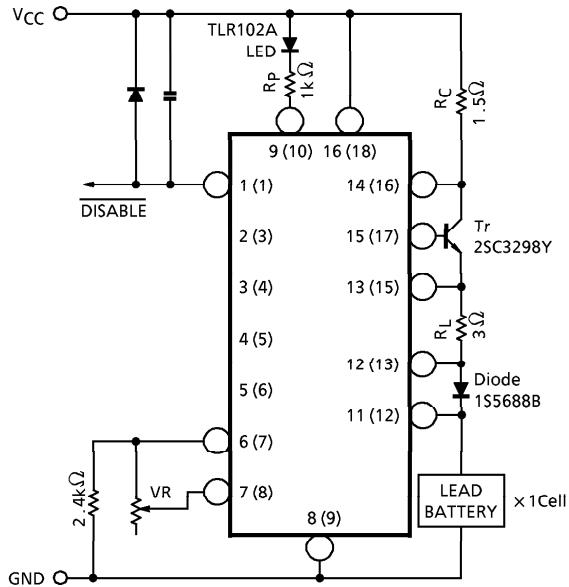
(5) 5Cells



(6) 6Cells



(7) DISABLE (ex. 1Cell)

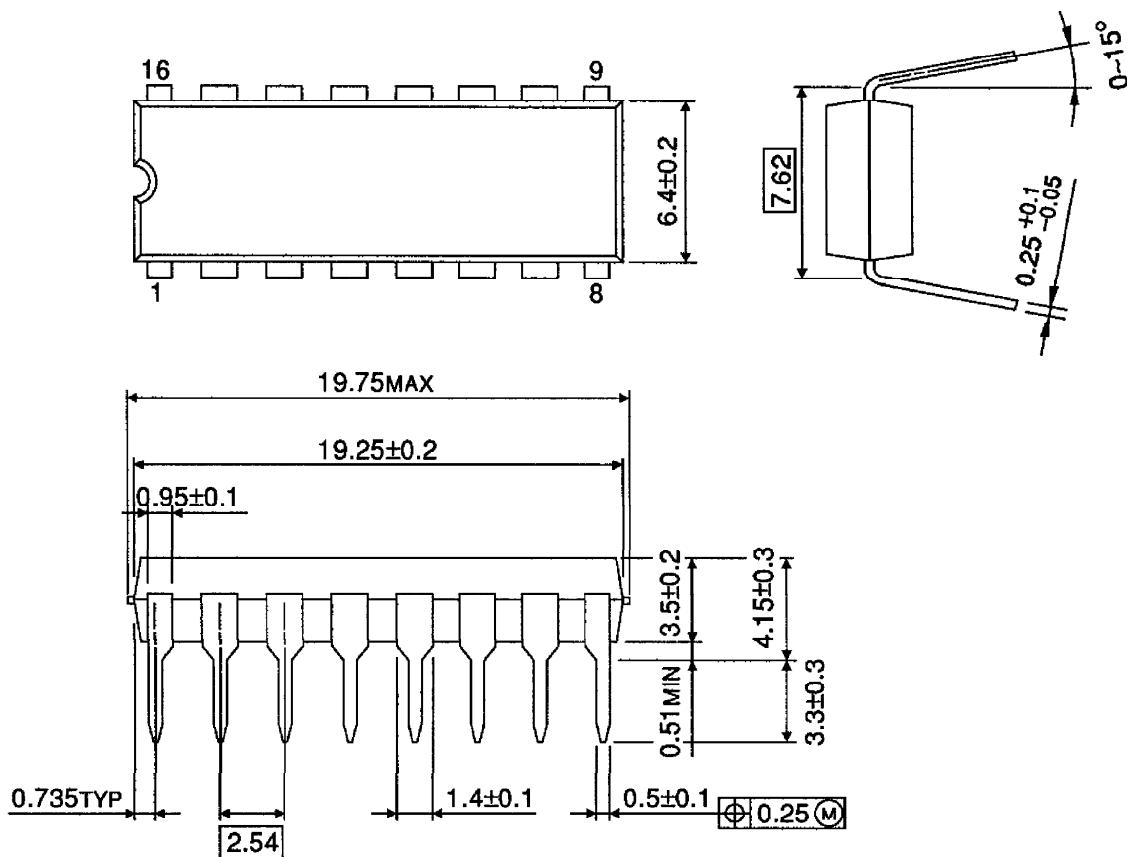


() : TA8532F pin No.

OUTLINE DRAWING

DIP16-P-300-2.54A

Unit : mm

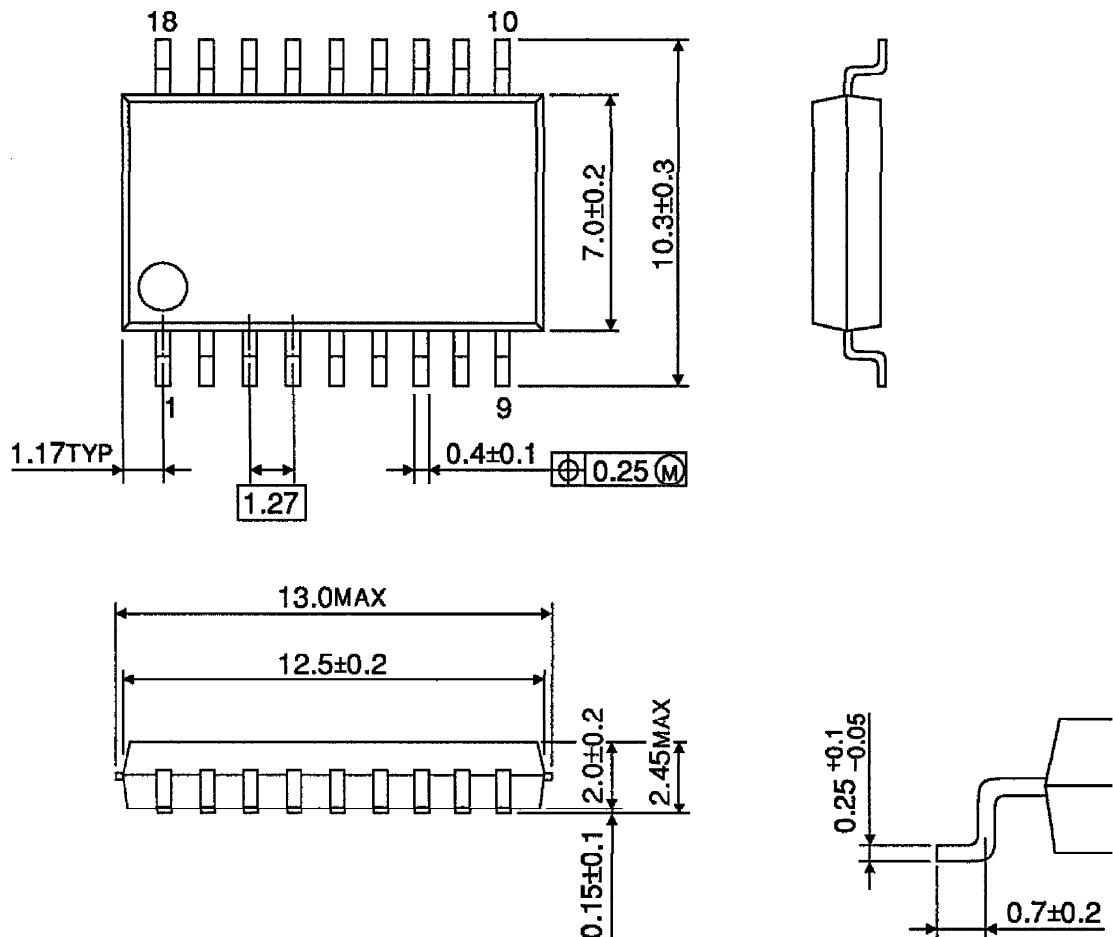


Weight : 1.0g (Typ.)

OUTLINE DRAWING

SOP18-P-375-1.27

Unit : mm



Weight : 0.5g (Typ.)