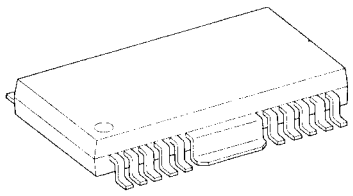
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA8041F

Dual Voltage Regulator with Watchdog Timer

The TA8041F is an IC specially designed for microcomputer systems. It incorporates a highly accurate 5±0.15V constant-voltage power supply and various system reset functions.
The power supply section produces two outputs : main output and sub-output. The main output can be controlled for its on / off through the EN pin.
For system reset, it has a voltage monitoring function as well as a watchdog timer which can self-diagnose the microcomputer system so that program runaway can be prevented.
It also has a reverse battery protection function, a current limiter and a thermal protection function.
Since its standby current is as small as 1mA, it can be connected directly to an automotive battery.



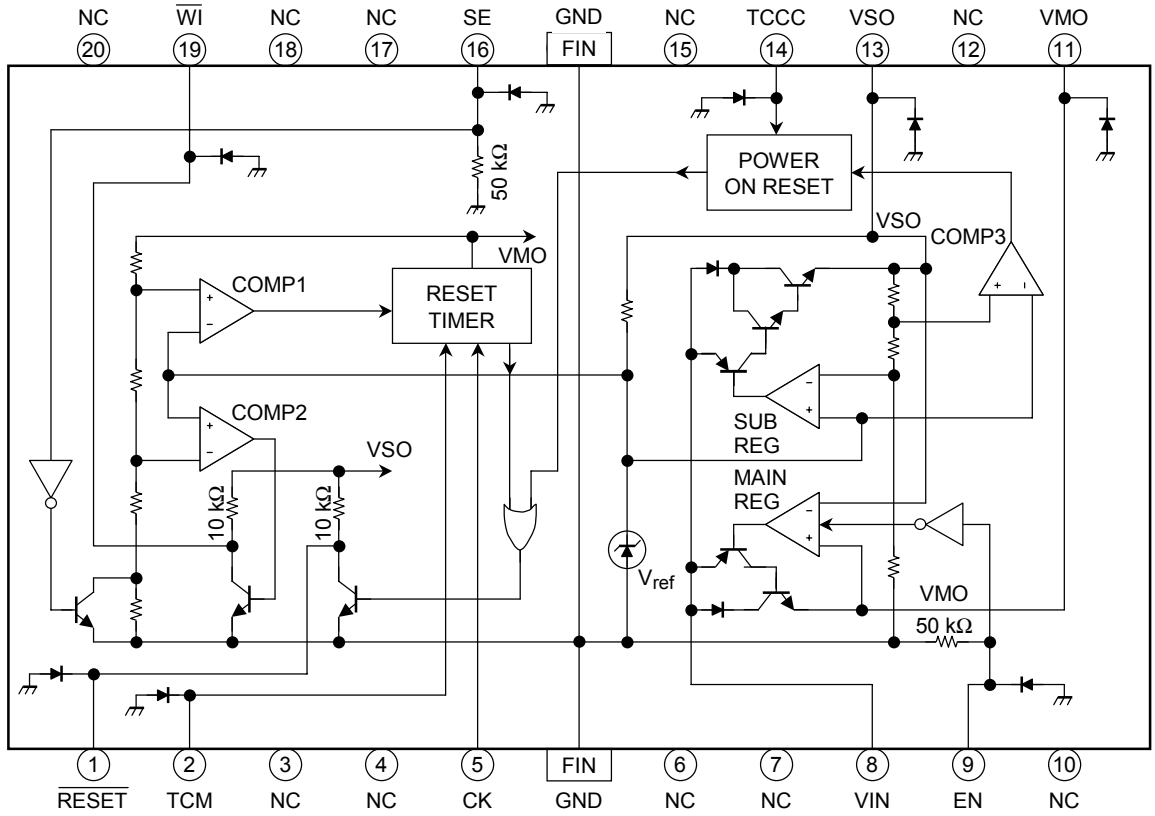
HSOP20-P-450-1.00

Weight: 0.79 g (Typ.)

FEATURES

- Accurate output : 5 V ± 0.15 V
- Difference between main and sub output voltage
  : ± 25 mV
- Output power transistor incorporated Current capacity
  : Main :250 mA (max)
  Sub :100 mA (max)
- Low standby current : 100 mA (max)
- Multiple protective function : Reverse battery connection, thermal-shutdown, current limiter
- Power Flat Package (PFP) HSOP 20 pin

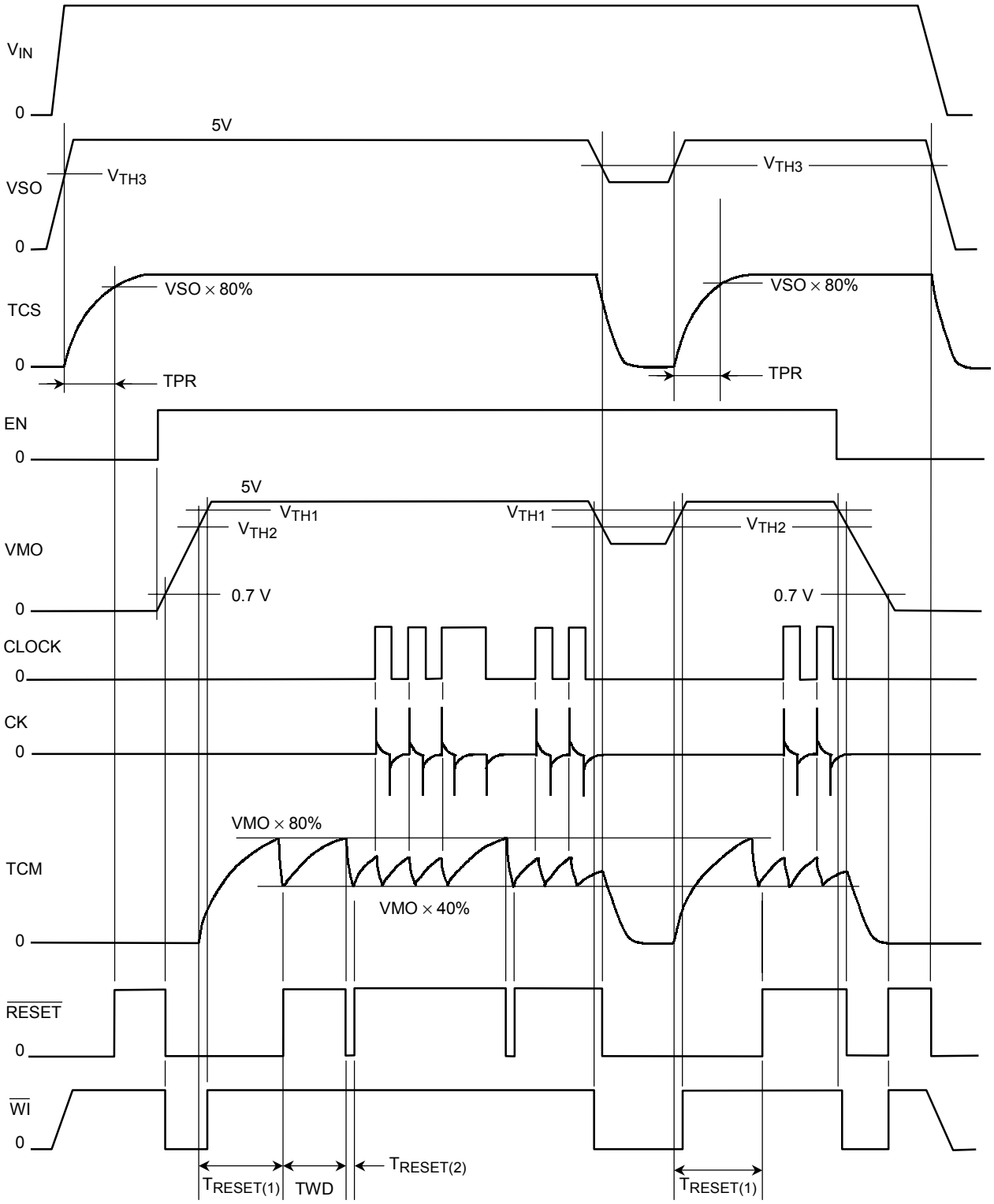
BLOCK DIAGRAM AND PIN LAYOUT



PIN DESCRIPTION

PIN No.	SYMBOL	DESCRIPTION
1	$\overline{\text{RESET}}$	Watchdog timer reset pin. • Generates a reset signal which is determined by the C_{T2}, R_{T2} combination connected to the TCM pin. • Intermittently generates reset pulses if no clock is supplied to the CK pin.The RESET signal is the output from the collector of an NPN transistor with a pull-up resistor (10kΩ).
2	TCM	Pin for setting a time for the reset timer and watchdog timer. It connects to a resistor R_{T2} which leads to V_{MO} and a capacitor C_{T2} which is grounded.
5	CK	Clock input pin for the watchdog timer. If it is used for a power-on reset timer only, it is pulled up to V_{MO}.
8	V_{IN}	Power supply pin for both main and sub power supplies.
9	EN	Enable pin for ON / OFF control of the main power output. The main output is 5V when the signal at this pin is high ; it is in standby state when the signal is low. It conects to 50kΩ resistor which pulled down to GND.
11	VMO	Main output pin for 5V constant-voltage power supply. It has a current capacity of up to 250mA. This pin is also a power supply pin for the reset timer. The ON / OFF control of power supply is possible by setting EN pin.
13	VSO	Sub output pin for 5V constant-voltage power supply. It has a current capacity of up to 100mA.
14	TCS	Pin for setting a time for the power-on reset timer of sub output. It connects to a resister R_{T1} which leads to V_{MO} and a capacitor C_{T1} which is grounded.It conects to 50kΩ resistor which pulled down to GND.
16	SE	Detection voltage select pin for power monitoring : Low : V_{TH1} = 4.80V, V_{TH2} = 4.40V High : V_{TH1} = 4.60V, V_{TH2} = 4.20V It conects to 50kΩ resistor which pulled down to GND.
19	$\overline{\text{WI}}$	Reset detect voltage VTH1 output pin. The reset detect voltage has a hysteresis of 0.2V. It is the output from the collector of an NPN transistor with a pull-up resistor (10kΩ).
fin	GND	Grounded.
3, 4, 6, 7, 10, 12, 15, 17, 18, 20	NC	Not connected. (Electrically, this pin is completely open.)

TIMING CHART



Note: See Electrical Characteristics for symbols in the timing chart.

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	PIN	RATING	UNIT
Input Voltage	V_{IN1}	V_{IN}	40 (1 s)	V
	V_{IN2}	V_{IN}	−30 (Note)	
	V_{IN3}	CK	−5~VSO	
	V_{IN4}	EN, SE	−0.5~V_{IN}	
Output Current	I_{LOAD-M}	VMO	250	mA
	I_{LOAD-S}	VSO	100	
	I_{OUT}	$\overline{\text{RESET}}$, $\overline{\text{WI}}$	2	
Output Voltage	V_{OUT}	$\overline{\text{RESET}}$, $\overline{\text{WI}}$	VSO	V
Power Dissipation	P_D	—	2.0	W
Operating Temperature	T_{opr}	—	−40~105	°C
Storage Temperature	T_{stg}	—	−55~150	°C
Lead Temperature-time	T_{sol}	—	260 (10 s)	°C

Note: Reverse Battery

MAXIMUM OUTPUT CURRENT (RECOMMENDED VALUES FOR APPLICATION Ta = 25°C)

Ambient Temperature Ta (°C)	Heat Radiation Condition	Allowable Power Dissipation (DC) P_D (W)	Output Current Dissipation (DC) (mA)
25	P_D4 : IC itself	1.0	75
	P_D3 : Using a board	2.0	166
	P_D2 : Using a board	3.2	275
85	P_D4 : IC itself	0.52	31
	P_D3 : Using a board	1.04	79
	P_D2 : Using a board	1.67	136
105	P_D4 : IC itself	0.36	17
	P_D3 : Using a board	0.72	49
	P_D2 : Using a board	1.15	89

Note: V_{CC} = 16 V
Output current dissipation is the sum of main output current and sub-output current.
For P_D2 and P_D3 in heat radiation condition, refer to P_D2 and P_D3 in THERMAL RESISTANCE DATA

ELECTRICAL CHARACTERISTICS(Unless otherwise specified, V_{IN} = 7~18 V, $I_{LOAD1-M}$ = 10 mA, I_{LOAD-S} = 10 mA, Tc = −40~105°C)

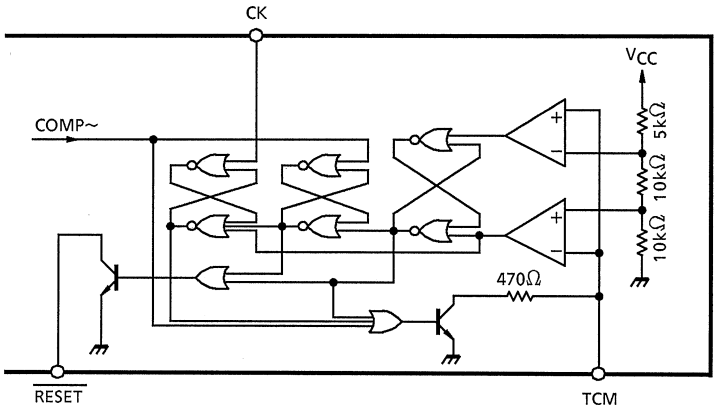
CHARACTERISTIC	SYMBOL	PIN	TEST CIR-CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Operating Voltage	V_{SUB}	VSO	—		4.85	5.0	5.15	V
Difference between Main and Sub Output Voltages	VSO-VMO	VMO, VSO	—		−25	—	25	mV
Line Regulation	V_{LINE}		—	V_{IN} = 7~40 V	—	2.5	5.0	%
Load Regulation	V_{LOAD-M}	VMO	—	I_{LOAD} = 1~100 mA	—	0.5	2.0	%
	V_{LOAD-S}	VSO	—	I_{LOAD} = 1~50 mA	—	0.3	1.0	
Temperature Coefficient		VSO	—		—	0.01	—	%/°C
Drop Out Voltage between I / O	V_{DROP-M}	VMO	—	I_{LOAD} = 300 mA	—	1.5	2.3	V
	V_{DROP-S}	VSO	—	I_{LOAD} = 100 mA	—	2.6	3.9	
Current Limiter	I_{LIMIT}	VMO	—		—	250	—	mA
Thermal-Shutdown Temperature	T_{SD}		—		—	150	—	°C
Input Current	I_{IN}	EN, SE	—	V_{IN} = 5 V	—	100	200	μA
				V_{IN} = 0 V	—	—	10	
Input Voltage	V_{IH}	EN, SE	—		2.0	—	—	V
	V_{IL}		—		—	—	1.0	
Output Voltage	V_{OL}	$\overline{RST}$, $\overline{WI}$	—	I_{OL} = 1 mA	—	—	0.5	V
Input Current	I_{IN}	TCS	—	V_{IN} = 0~VSO	−3	—	3	μA
Threshold Voltage	V_{TH}	TCS	—		—	VSO × 80%	—	V
Input Current	I_{IN}	TCM	—	V_{IN} = 0~3.5 V	−3	—	3	μA
Threshold Voltage	V_{IH}	TCM	—		—	VMO × 80%	—	V
	V_{IL}		—		—	VMO × 40%	—	
Input Current	I_{IN}	CK	—	V_{IN} = 5 V	—	0.17	0.35	mA
Input Voltage	V_{IH}	CK	—		2.0	—	—	V
	V_{IL}		—		—	—	0.5	
Reset Threshold Voltage	V_{TH1-H}	VMO	—	SE = GND	—	VMO × 96%	—	V
	V_{TH1-L}		—	SE = V_{REG}	—	VMO × 92%	—	
	V_{TH2-H}		—	SE = GND	—	VMO × 88%	—	
	V_{TH2-L}		—	SE = V_{REG}	—	VMO × 84%	—	
	V_{TH3}	VSO	—		—	VMO × 84%	—	
Standby Current	I_{ST}	V_{IN}	—	V_{IN} = 14 V, EN = "L"	—	0.5	1.0	mA

CHARACTERISTIC	SYMBOL	PIN	TEST CIR-CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Power-on Reset	T_{PR}	$\overline{RESET}$	—		$1.3 \times C_{T1} \times R_{T1}$	$1.6 \times C_{T1} \times R_{T1}$	$1.9 \times C_{T1} \times R_{T1}$	ms
Watchdog Timer	T_{WD}	$\overline{RESET}$	—		$0.9 \times C_{T2} \times R_{T2}$	$1.1 \times C_{T2} \times R_{T2}$	$1.3 \times C_{T2} \times R_{T2}$	
Reset Timer (1)	$T_{RST\ (1)}$	$\overline{RESET}$	—		$1.3 \times C_{T2} \times R_{T2}$	$1.6 \times C_{T2} \times R_{T2}$	$1.9 \times C_{T2} \times R_{T2}$	
Reset Timer (2)	$T_{RST\ (2)}$	$\overline{RESET}$	—		$300 \times C_{T2}$	$700 \times C_{T2}$	$1500 \times C_{T2}$	μs
Clock Pulse Width	T_W	CK	—		3	—	—	μs

VREG:Regulated Voltage of V_{SO}

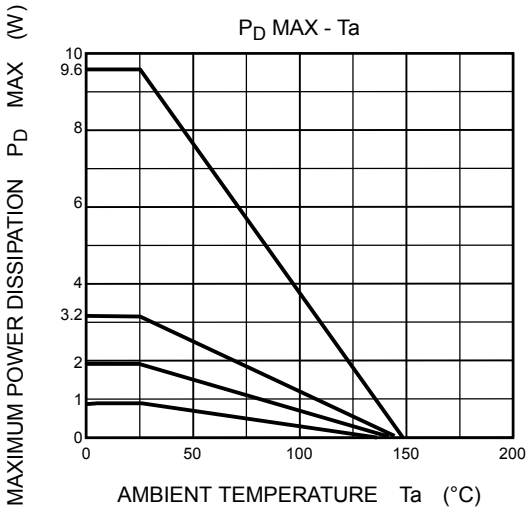
Note: The unit for C_{T1} and C_{T2} is μF, the unit for R_{T1} and R_{T2} is kΩ.

RESET TIMER EQUIVALENT CIRCUIT

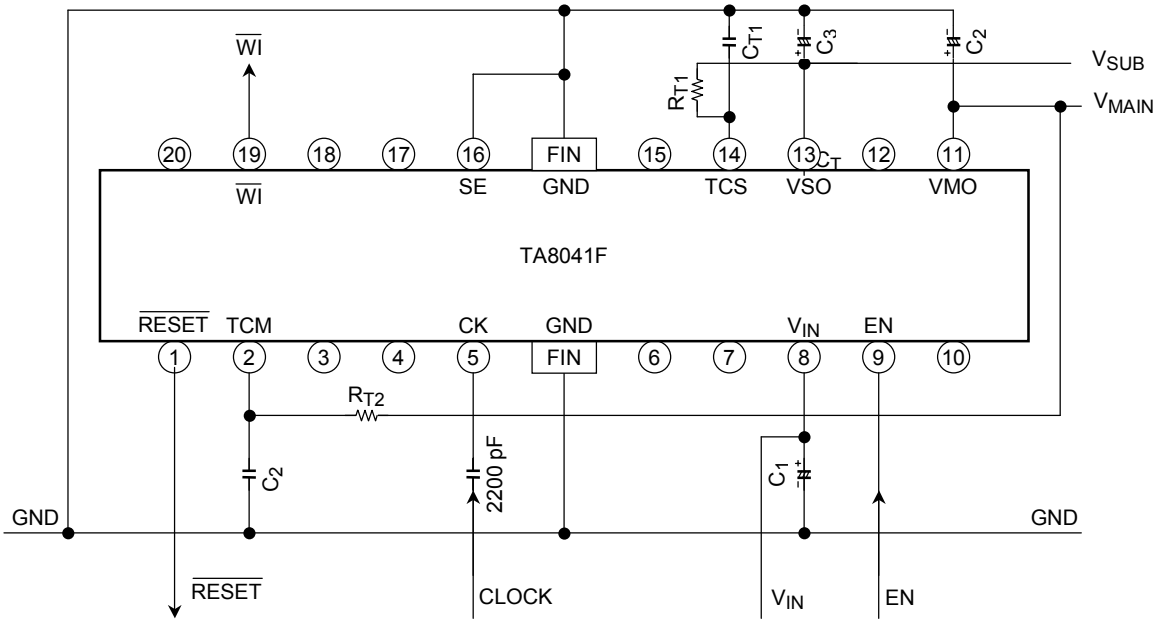


HSOP20-P-450-1.00 THERMAL RESISTANCE DATA (Ta = 25°C)

CHARACTERISTIC	TEST CONDITION	RATING	UNIT
$R_{\theta\ j\text{-}a}$	—	125	°C/W
$R_{\theta\ j\text{-}c}$	—	13	°C/W
P_{D1}	Without a board	9.6	W
P_{D2}	50 × 50 × 1.0 mm Iron board mounted	3.2	W
P_{D3}	50 × 50 × 1.6 mm 50% Cu mounted	2.0	W
P_{D4}	Without a board	1.0	W



EXAMPLE OF APPLICATION CIRCUIT



*: Caution for Wiring

1. C_1, C_2 and C_3 are for absorbing disturbance, noise, etc.

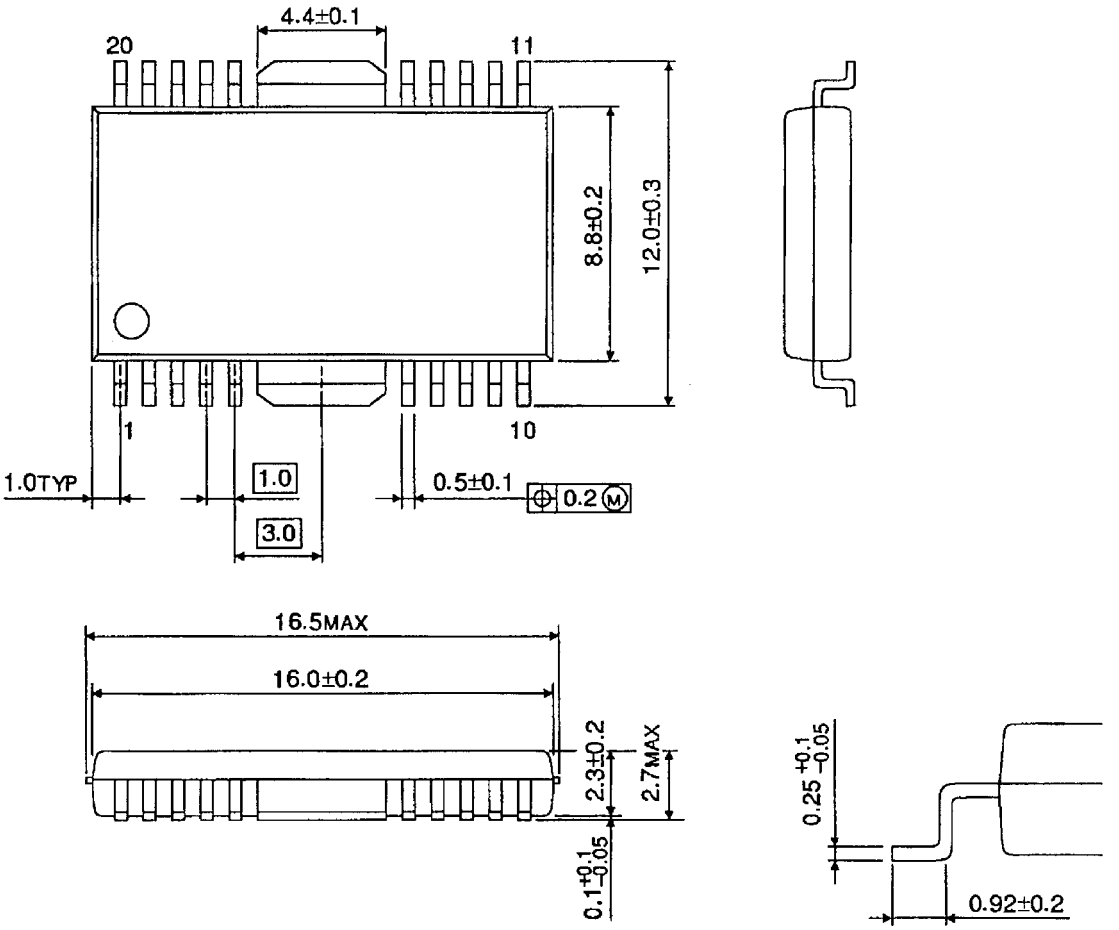
   Connect them as close to the IC as possible.

RECOMMENDED CONDITIONS

PART NAME	MIN	MAX	UNIT
C_{T1}	0.01	100	μF
C_{T2}	0.01	100	μF
R_{T1}	5	100	kΩ
R_{T2}	5	100	kΩ

PACKAGE DIMENSIONS

HSOP20-P-450-1.00 Unit : mm



Weight: 0.79 g (Typ.)

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