

TOSHIBA BIPOLAR DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

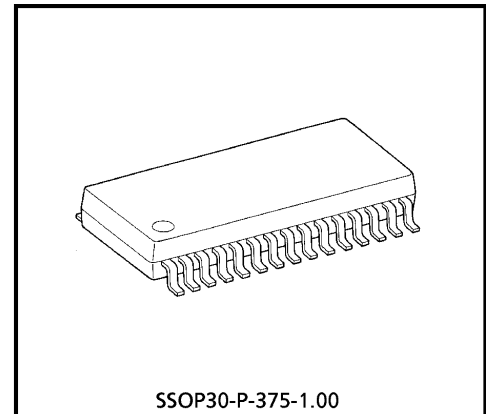
TD62650F, TD62651F, TD62652F**5V POWER SUPPLY & SUPPLY MONITORING + COMMUNICATIONS IC**

The TD6265xF series covers products developed for use in microcomputer systems applicable to automatic vending machines. They produce an output voltage of $5V \pm 0.5V$ without need for adjustment, through their accurate reference voltage and amplifier circuit.

The 5V section can reset the system by outputting reset signals at power-on, and also output a reset signal when the 5V output voltage drops below the specified 92% (TD62650F/652F) or 85% (TD62651F) because of external disturbances or other problem.

It also incorporates a watchdog timer for self-diagnosing the system. When the system malfunctions, the IC generates reset pulses intermittently to prevent the system from running away.

The interface section incorporates three serial ports corresponding to the typical 24-V 4800bps system in microcomputers.



Weight : 0.63g (Typ.)

FEATURES

- Accurate output : $5V \pm 0.25V$
- Output PNP Tr incorporated : Current capacity ; 300mA (max)
- Power-on Reset timer incorporated
- Watchdog timer incorporated
- Small flat package sealing : MFP30 pin (1mm pitch)

961001EBA1

- TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.
- The products described in this document are subject to foreign exchange and foreign trade control laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.

- Difference 1

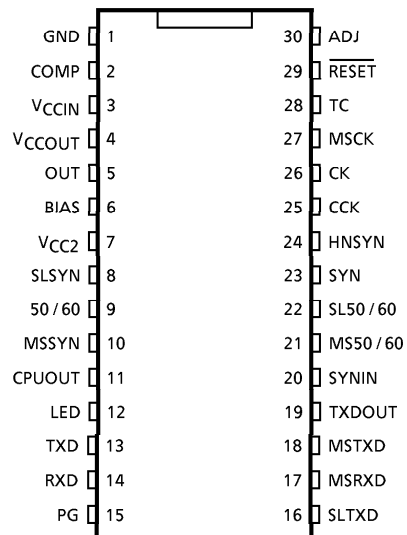
CHARACTERISTIC	TD62650 / 652F	TD62651F
Reset Detecting Voltage	5V / 92%	5V / 85%

- Difference 2

Time setting resistance 22kΩ for power-on reset / watchdog timer, and PULL resistance of 4.7kΩ for RESET pin.

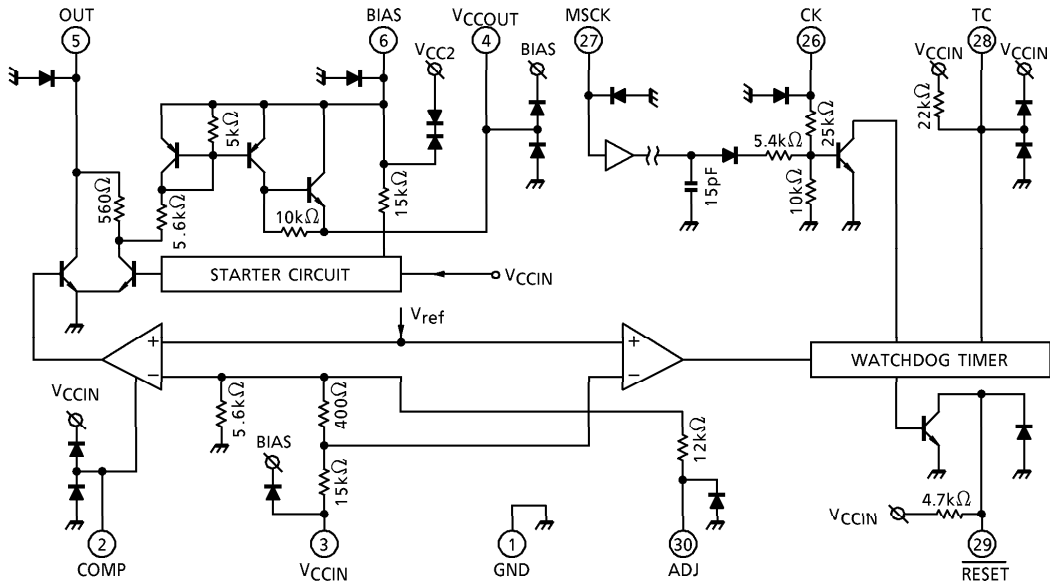
TD62650F	TD62651F	TD62652F
Built-in	None	None

PIN CONNECTION

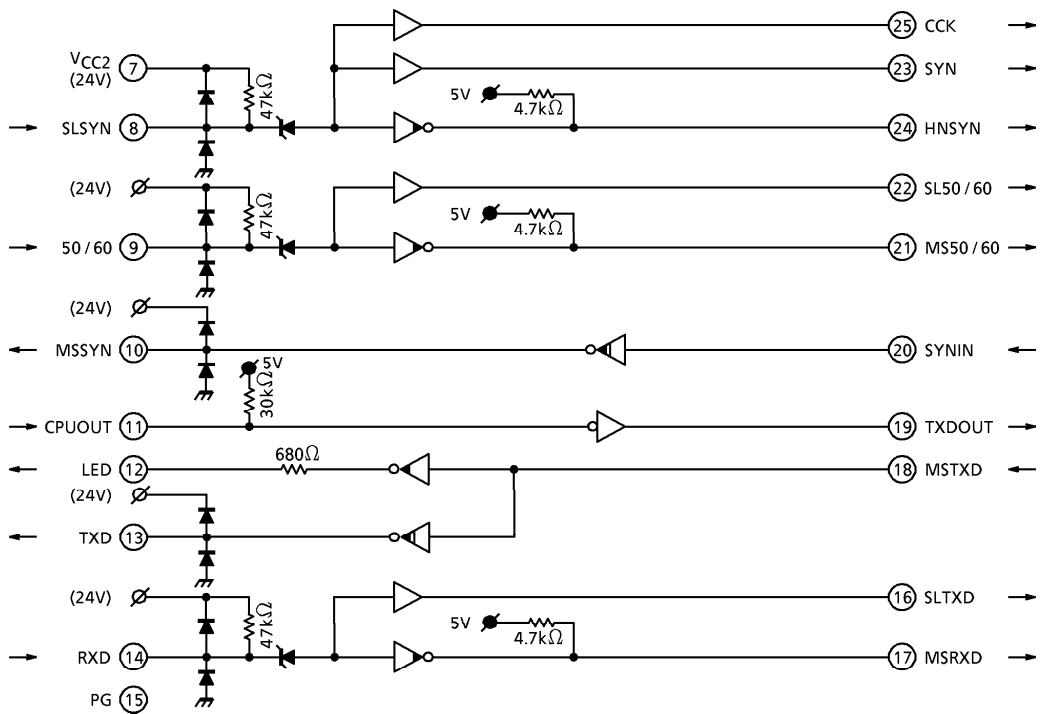


TD62650F BLOCK DIAGRAM

5V POWER SUPPLY + SUPPLY MONITORING



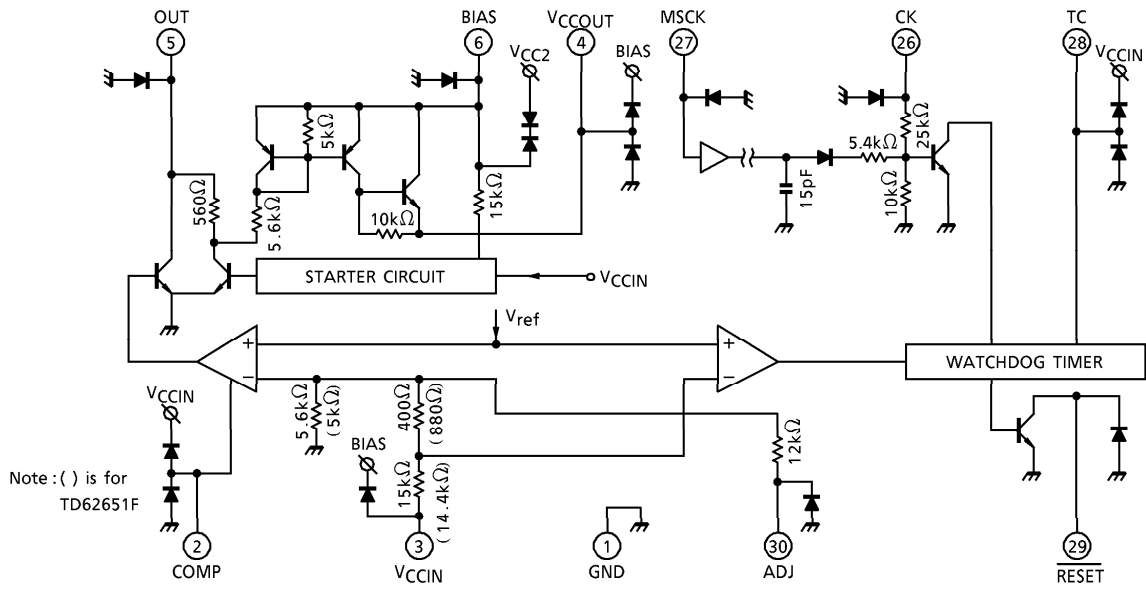
INTERFACE



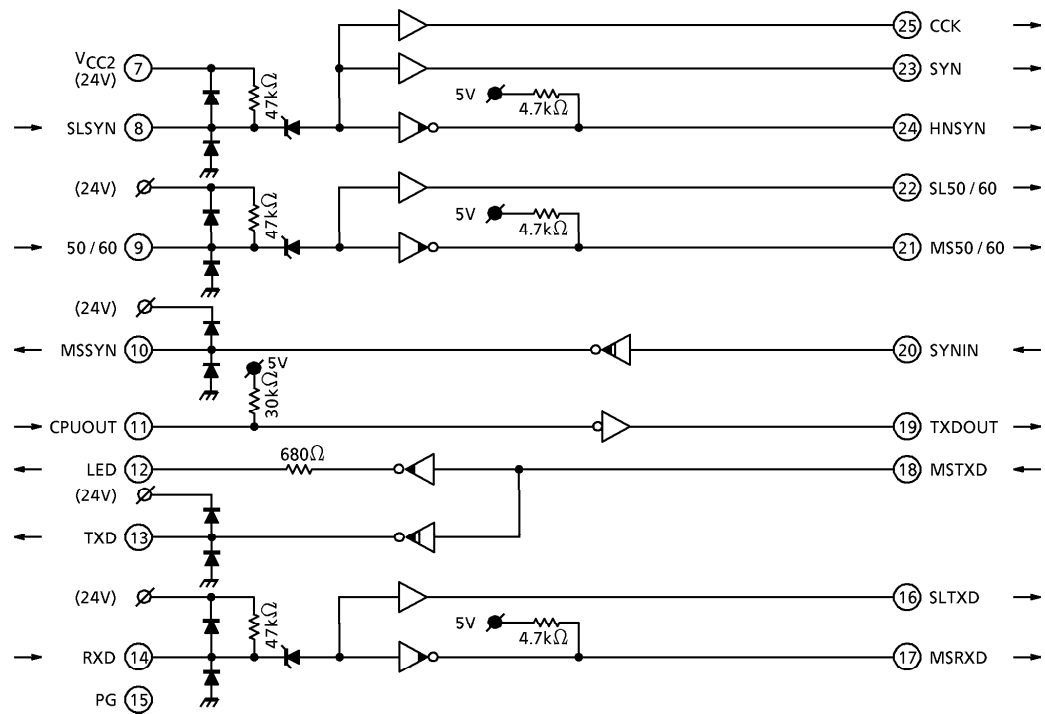
: 5-V System Push Pull INV
 : 5-V System Open Collector
 : 24-V System Open Collector
 : 5-V System Push Pull Buffer

TD62651F / TD62652F BLOCK DIAGRAM

5V POWER SUPPLY + SUPPLY MONITORING

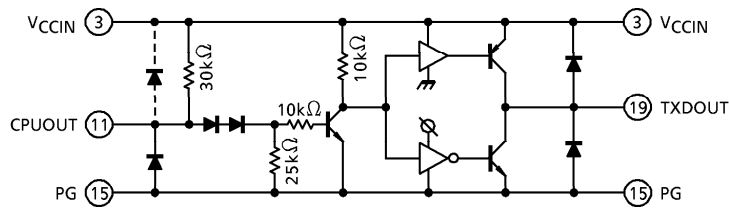
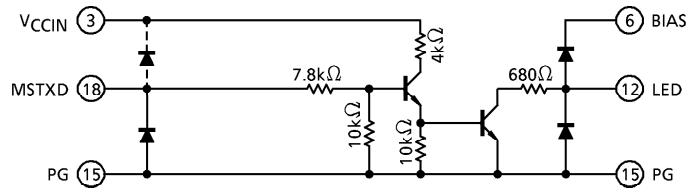
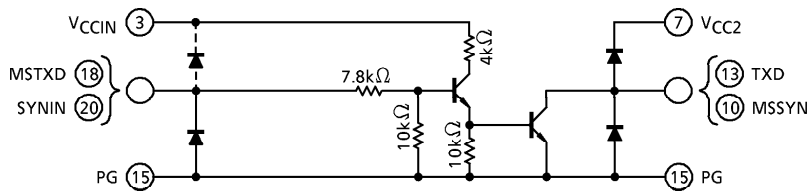
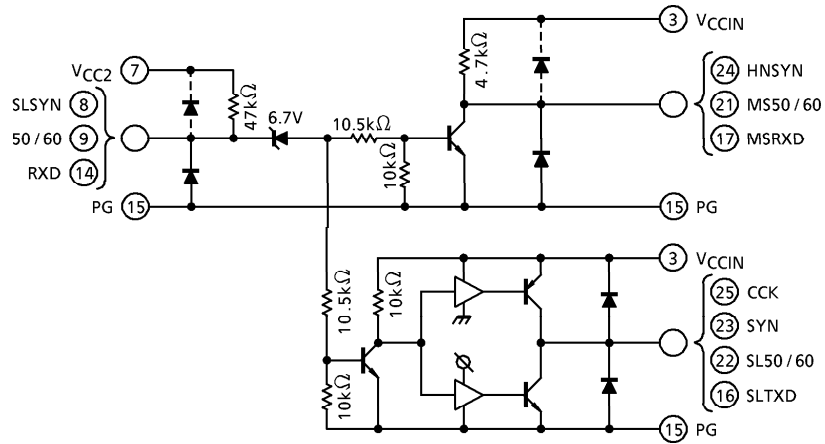


INTERFACE



: 5-V System Push Pull INV
 : 5-V System Open Collector
 : 24-V System Open Collector
 : 5-V System Push Pull Buffer

INTERFACE INPUT / OUTPUT CIRCUITS

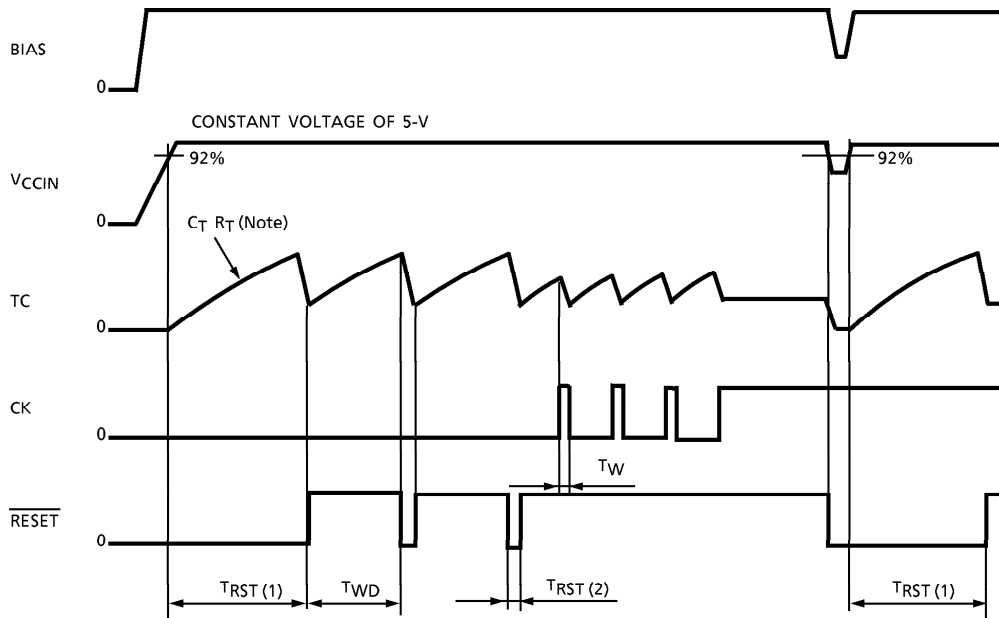


PIN FUNCTION

PIN No.	PIN NAME	PIN FUNCTION
1	GND	GND pin for 5V power supply and supply monitoring.
2	COMP	Phase compensation pin for output stabilization.
3	VCCIN	Power supply pin for internal circuit. The output voltage can also be detected at this pin.
4	VCCOUT	Output pin for built-in Power Tr, having a current capacitance of 300mA (max). It is also used as an output pin for 5V constant power supply through shorting with VCCIN pin.
5	OUT	Connected to the base of an external PNP transistor so that the output voltage is stabilized. Current design suitable for load capacities is thus possible. Since the recommended I _{OUT} current is 5mA, an output current of 300mA is assured if the external transistor has an hFE of 60. When the internal transistor is used, it can be opened.
6	BIAS	Power supply starting pin. The starting current is supplied through a resistor to which the input voltage is applied. When VCCIN rises above 3.0V, the starting current is absorbed in the internal circuit ; instead, I _{OUT} is supplied via VCCIN.
7	VCC2	Power supply pin for the 24-V system.
8	SLSYN	Input pin for the 24-V system interface. Pull-up resistor 47kΩ is incorporated at VCC2 pin.
9	50 / 60	Input pin for 24-V system interface. Pull-up resistor 47kΩ is incorporated at VCC2 pin.
10	MSSYN	Output pin for the 24-V system open collector.
11	CPUOUT	Input pin for the 5-V system Push/Pull inverter. Pull-up resistor 30kΩ is incorporated at VCCIN pin.
12	LED	LED lighting pin for the 8 system open collector. 680Ω limiting resistor is incorporated.
13	TXD	Output pin for the 24-V system open collector.
14	RXD	Input pin for the 24-V system interface. Pull-up resistor 47kΩ is incorporated at the VCC2 pin.
15	PG	GND pin for the 5-V / 24-V system interfaces.
16	SLTXD	Output pin for the 5-V system open collector. Pull-up resistor 4.7kΩ is incorporated at the VCCIN pin.
17	MSRXD	Output pin for the 5-V system Push-Pull buffer.
18	MSTXD	Input pin for the 5-V system interface, for input at LED (12 pin) and TXD (13 pin) pins.
19	TXDOUT	Output pin for the 5-V system Push / Pull inverter (CPUOUT : 11 pin).
20	SYNIN	Input pin for the 5-V system interface.
21	MS50 / 60	Output pin for the 5-V system open collector. Pull-up resistor 4.7kΩ is incorporated at VCCIN pin.
22	SL50 / 60	Output pin for the 5-V system Push/Pull buffer.
23	SYN	Output pin for the 5-V system Push-Pull buffer.
24	HNSYN	Output pin for the 5-V system open collector. Pull-up resistor 4.7kΩ incorporated at VCCIN pin.
25	CCK	Output pin for the 5-V system Push-Pull buffer.

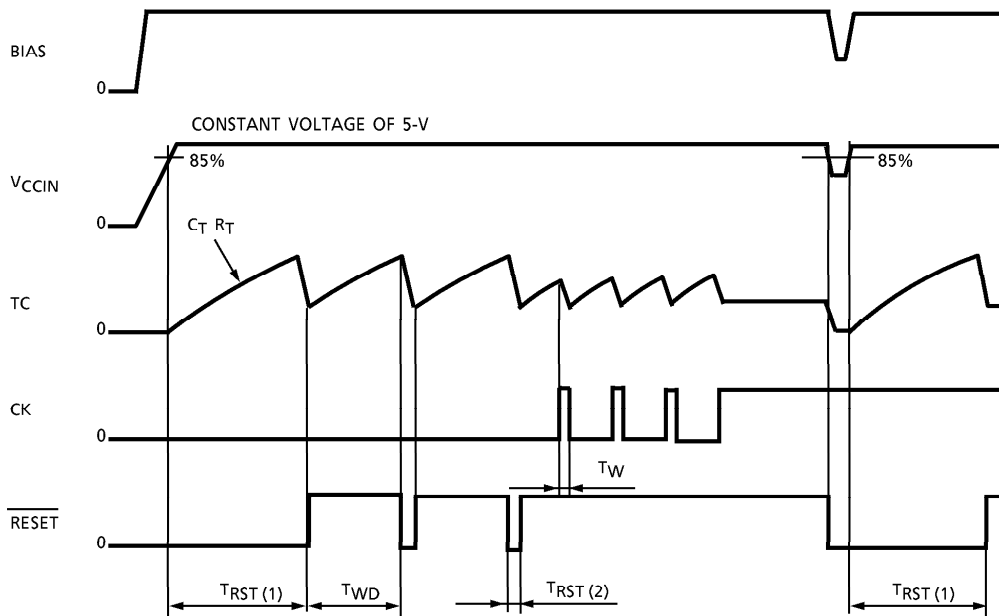
PIN No.	PIN NAME	PIN FUNCTION
26	CK	Input pin for watchdog timer. The pin is pulled up to V_{CCIN} if the IC is used only as a power-on reset timer.
27	MSCK	To input clock pulses, one-shot pulses can be generated for CK (26 pin) inputs at the rise edge. When the pin is not used, short it with GND.
28	TC	Time setting pin for the reset and watchdog timers.
29	$\overline{\text{RESET}}$	<p>NPN transistor open-collector output.</p> <p>(1) The signal goes low when the output voltage drops below the specified 92% (TD62650/652) or 85% (651F) level.</p> <p>(2) The pin generates a reset signal that is determined by the external condenser connected to the TC pin.</p> <p>(3) The pin generates reset pulses intermittently if no clock is attached to the CK pin.</p> <p>This function can be used as a watchdog timer for microcomputers.</p>
30	ADJ	Output voltage adjusting pin. The voltage will increase when a resistor is connected between ADJ and GND (1 pin). It can reduce the voltage when the resistor is inserted between ADJ and V_{CCIN} (3 pin). The voltage can be changed by a maximum of $\pm 1V$.

TIMING CHART (TD62650F, TD62652F)



(Note) TD62650F incorporates RT (22kΩ (Typ.) only for C_T.)

TIMING CHART (TD62651F)



MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT	PIN
Input Voltage	V _{VCC24}	-0.4~35	V	V _{CC2} , BIAS
	V _{VCCIN}	-0.4~7	V	V _{CCIN}
	V _{IN24} (Condition 1) (Condition 2)	-0.4~V _{VCC2} + 0.4 -0.4~30	V	SLSYN, 50 / 60, RXD
	V _{IN5}	-0.4~V _{VCCIN} + 0.4	V	CPUOUT, MSCK, ADJ, COMP, CK, TC, SYNIN, MSTXD
Output Voltage	V _{OUT24}	-0.4~V _{VCC2} + 0.4	V	MSSYN, TXD
	V _{VCCOUT}	-0.4~V _{BIAS} + 0.4	V	V _{CCOUT} , OUT
	V _{LED} (Condition 3) (Condition 4)	-0.4~V _{BIAS} + 0.4 -0.4~10	V	LED
	V _{OUT5}	-0.4~V _{VCCIN} + 0.4	V	RESET, CCK, HNSYN, SYN, SL50 / 60, MS50 / 60, TXDOUT, MSRXD, SLTXD
Output Current	I _{OUT}	10	mA	OUT
	I _{RESET}	4	mA	RESET
	I _{OUT Push / Pull}	±4	mA / ch	CCK, SYN, SL50 / 60, TXDOUT, SLTXD
	I _{OUT5}	10	mA / ch	HNSYN, MS50 / 60, LED, MSRXD
	I _{OUT24}	24	mA / ch	MSSYN, TXD
	I _{VCCOUT}	300	mA	V _{CCOUT}
Power Dissipation	P _D (Note 5)	1.47	W	
Operating Temperature	T _{opr}	-40~85	°C	
Storage Temperature	T _{stg}	-55~150	°C	

(Condition 1) V_{VCC2} ≤ 29.6V(Condition 2) V_{VCC2} > 29.6V(Condition 3) V_{BIAS} ≤ 9.6V(Condition 4) V_{BIAS} > 9.6V

(Note 5) Board mounting time (50 × 50 × 1.6mm, Cu = 30%)

DC ELECTRICAL CHARACTERISTICS (Ta = 25°C, VCCIN = 5V)

Interface Section

CHARACTERISTIC	SYMBOL	PIN	TEST CIR-CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Input Voltage	V _{IH5}	(Note 1)	—		V _{CCIN} × 70%	—	—	V
	V _{IL5}				—	—	V _{CCIN} × 30%	
	V _{IH24}	(Note 2)			13	—	V _{CC2} + 0.4	
	V _{IL24}				-0.4	—	7	
Input Current	I _{IH5-1}	(Note 3)	—	V _{IN} = 5V	320	462	600	μA / ch
	I _{IL5-1}			V _{IN} = 0V	—	0	10	μA
	I _{IH5-2}	(Note 7)		V _{IN} = 5V	480	690	940	
	I _{IL5-2}			V _{IN} = 0V	115	170	240	
	I _{IH24}	(Note 2)		V _{IN} = 24V	1.1	1.6	2.1	mA / ch
	I _{IL24}			V _{IN} = 0V	350	510	690	μA
Output Voltage	V _{OH5-1}	(Note 4)	—	I _{OH} = -20μA	V _{CC} - 0.1	—	—	V
	V _{OH5-2}			I _{OH} = -4mA	V _{CCIN} × 70%	—	—	
	V _{OL5-1}			I _{OL} = 20μA	—	—	0.1	
	V _{OL5-2}			I _{OL} = 4mA	—	—	V _{CCIN} × 30%	
	V _{OL5-3}	(Note 5)		I _{IIN} = 500μA I _{OL} = 10mA	—	—	0.5	
	V _{OL LED}	LED		I _{IIN} = 200μA I _{OL} = 1mA	—	—	1.4	
	V _{OL24}	(Note 6)		I _{IIN} = 200μA I _{OL} = 24mA	—	—	0.5	
Output Impedance	R _{OL LED}	LED	—	(Note 8)	540	680	1000	Ω
	R _{OH5}	(Note 5)		(Note 9)	3.2	4.7	6.2	kΩ
Current Consumption 24	I _{VCC2}		—	V _{VCC2} = 24V	—	1.6	2.1	mA
Leakage Current	I _{LEAK24}	(Note 6)	—	V _{OH} = 24.0V	—	—	10	μA
	I _{LEAK5}	(Note 4)		V _{OH} = 5V	—	—	10	
Output Shorting Current	I _{OS} (*)	(Note 4)	—	V _{CCIN} = 5.25V V _{OH} = 0V	—	17.5	—	mA

(*) Two outputs or more must not be shorted at the same time.
Shorting duration must be limited to less than 1 second.

(Note 1) CPUOUT, SYNIN, MSTXD

(Note 5) HNSYN, MS50 / 60, MSRXD

(Note 2) SLSYN, 50 / 60, RXD

(Note 6) MSSYN, TXD

(Note 3) SYNIN, MSTXD

(Note 7) CPUOUT

(Note 4) CCK, SYN, SL50 / 60, TXDOUT, SLTXD

(Note 8) (V_{OL} (@I_{OL} = 5mA) - V_{OL} (@I_{OL} = 1mA)) ÷ 4mA

(Note 9) 4V ÷ (@I_{OH} (V_{OH} = 0V) - @I_{OH} (V_{OH} = 4V))

DC ELECTRICAL CHARACTERISTICS (Unless otherwise specified, $V_{BIAS} = 7$ to $17V$, $T_a = -40$ to $85^\circ C$)
 5V power supply, supply monitoring section

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Output Voltage	V_{CCOUT}	—	$I_{VCCOUT} = 0.1A$	4.75	5.0	5.25	V
Input Stability	V_{CCOUT} LINE	—	$V_{BIAS} = 7 \sim 35V$	—	0.1	0.5	%
Load Stability	V_{CCOUT} LOAD	—	$I_{VCCOUT} = 1 \sim 150mA$	—	0.1	0.5	%
Temperature Coefficient	V_{CCOUT} t	—		—	0.01	—	% / $^\circ C$
Output Voltage	V_{OL} \overline{RESET}	—	$I_{OL} = 2mA$	—	—	0.5	V
Output Leakage Current	I_{LEAK} \overline{RESET}	—	$V_{RESET} = 7V$	—	—	5	μA
Input Current	I_{TC}	—	$V_{TC} = 0$ to $3.5V$ (Note 8)	-3	—	3	μA
Threshold Voltage	V_{TC} H	—	\overline{RESET} "High" to "Low"	—	$80\% \times V_{CCIN}$	—	V
	V_{TC} L	—	\overline{RESET} "Low" to "High"	—	$40\% \times V_{CCIN}$	—	
Input Current	I_{CK}	—	$V_{IN} = 5V$ (Note 8)	—	0.3	0.7	mA
Input Voltage	V_{IH}	—	(Note 4)	$V_{CCIN} \times 70\%$	—	—	V
	V_{IL}			—	—	$V_{CCIN} \times 30\%$	
Reset Detecting Voltage	V_{CC} \overline{RESET}	—	TD62650 / 652F	$89\% \times V_{CCIN}$	$92\% \times V_{CCIN}$	$95\% \times V_{CCIN}$	V
			TD62651F	$82\% \times V_{CCIN}$	$85\% \times V_{CCIN}$	$88\% \times V_{CCIN}$	
Output Impedance	R_{OH} \overline{RESET}	—	TD62650F (Note 1)	3.2	4.7	6.2	k Ω
	R_{OH} TC		TD62650F (Note 1)	15	22	29	
Current Consumption 5	I_{VCCIN}	—	(Note 2)	—	5	6.5	mA
			(Note 5)	—	11.5	15.0	
Bias Current Consumption	I_{BIAS}	—	$V_{BIAS} = 8V$ (Note 7)	—	1.73	2.25	mA
Watchdog Timer	T_{WD}	—	TD62650F (Note 6)	$15.4 \times CT$	$24.2 \times CT$	$33.0 \times CT$	ms
			TD62651 / 2F	$0.9 \times CT_{RT}$	$1.1 \times CT_{RT}$	$1.3 \times CT_{RT}$	s
Reset Timer (1) (Note 3)	T_{RST} (1)	—	TD62650F (Note 6)	$24.2 \times CT$	$35.2 \times CT$	$48.4 \times CT$	ms
			TD62651 / 2F	$1.3 \times CT_{RT}$	$1.6 \times CT_{RT}$	$1.9 \times CT_{RT}$	s
Reset Timer (Note 3)	T_{RST} (2)	—	(Note 6)	$300 \times CT$	$600 \times CT$	$900 \times CT$	ms

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Clock Input Pulse width	TW CK	—		3	—	—	μ s
Maximum Response Frequency 1	f _{MAX} MSCK	—		2	—	—	kHz
Maximum Response Frequency 2	f _{MAX} CK	—		10	—	—	kHz
Msck Pin Input Signal Rise Time	tr MSCK	—	(Note 9)	—	—	500	ns
Minimum Input / Output Voltage Difference	V _{OH} V _{CCOUT}	—	I _{VCCOUT} = 0.1A	—	—	1.5	V

(Note 1) $4V \div (@I_{OH} (V_{OH} = 0V) - @I_{OH} (V_{OH} = 4V))$

(Note 2) V_{BIAS} = 8V, V_{CCIN} - V_{CCOUT} Short

Open Collector I/O : Open

Push-Pull I/O : Open

MSCK Input : Open

(Note 3) Reset Timer (1) : Power On Reset Time

Reset Timer (2) : Watchdog Reset Time

(Note 4) MSCK, CK Pins

(Note 5) HNSYN, MS50/60, MSRXD Pull / UP Resistance + CCK, SYN, SL50/60, TXDOUT, SLTXD

Driving Current

(Note 6) CT Unit (μ F)

(Note 7) V_{CCIN}, V_{CCOUT} Open

(Note 8) Only TD62651F, TD62652F

(Note 9) Input Condition 5V : 0 to 100%

AC ELECTRICAL CHARACTERISTICS (Ta = 25°C)

CHARACTERISTIC	CHARACTERISTIC / INPUT CONDITION	SYMBOL	TEST CIR-CUIT	OUTPUT CONDITION	MIN	TYP.	MAX	UNIT
Propagation Delay Time (tpLH : 50%-50%, tpHL : 50%-50%)	SLSYN-CCK (Note 1)	tpLH	—	(Note 4)	—	0.6	—	μ S
		tpHL			—	1.5	—	
	SLSYN-SYN (Note 1)	tpLH		(Note 4)	—	0.6	—	
		tpHL			—	1.5	—	
	SLSYN-HNSYN (Note 1)	tpLH		(Note 5)	—	0.5	—	
		tpHL			—	0.1	—	
	50 / 60-MS50 / 60 (Note 1)	tpLH		(Note 5)	—	0.5	—	
		tpHL			—	0.1	—	
	50 / 60-SL50 / 60 (Note 1)	tpLH		(Note 4)	—	0.6	—	
		tpHL			—	1.5	—	
	SYNIN-MSSYN (Note 2)	tpLH		(Note 3)	—	1.0	—	
		tpHL			—	0.1	—	
	CPUOUT-TXDOUT (Note 2)	tpLH		(Note 4)	—	1.0	—	
		tpHL			—	1.2	—	
	MSTXD-LED (Note 2)	tpLH		(Note 5)	—	0.5	—	
		tpHL			—	0.1	—	
MSTXD-TXD (Note 2)	tpLH	(Note 3)	—	1.0	—			
	tpHL		—	0.1	—			
RXD-SLTXD (Note 1)	tpLH	(Note 4)	—	0.6	—			
	tpHL		—	1.5	—			
RXD-MSRXD (Note 1)	tpLH	(Note 5)	—	0.5	—			
	tpHL		—	0.1	—			
Rise Time (tr : 10%-90%)	MS50 / 60	tr	—		—	0.3	—	μ S
	SL50 / 60				—	0.2	—	
	LED				—	0.2	—	
	MSSYN				—	1.1	—	
	TXDOUT				—	0.2	—	
	TXD				—	1.1	—	
	SYN				—	0.2	—	
	CCK				—	0.2	—	
	HNSYN				—	0.3	—	
	SLTXD				—	0.2	—	
	MSRXD				—	0.3	—	

CHARACTERISTIC	CHARACTERISTIC / INPUT CONDITION	SYMBOL	TEST CIR-CUIT	OUTPUT CONDITION	MIN	TYP.	MAX	UNIT
Fall Time (t_f : 90%-10%)	MS50 / 60	t_f	—		—	0.1	—	μs
	SL50 / 60				—	0.5	—	
	LED				—	0.1	—	
	MSSYN				—	0.1	—	
	TXDOUT				—	0.5	—	
	TXD				—	0.1	—	
	SYN				—	0.5	—	
	CCK				—	0.5	—	
	HNSYN				—	0.1	—	
	SLTXD				—	0.5	—	
	MSRXD				—	0.1	—	

Input / Output Conditions

- Input Condition

(Note 1) 24-V System : $0.2\mu s$ at 2 to 22-V

(Note 2) 5-V System : $0.1\mu s$ at 30 to 70%

- Output Conditions

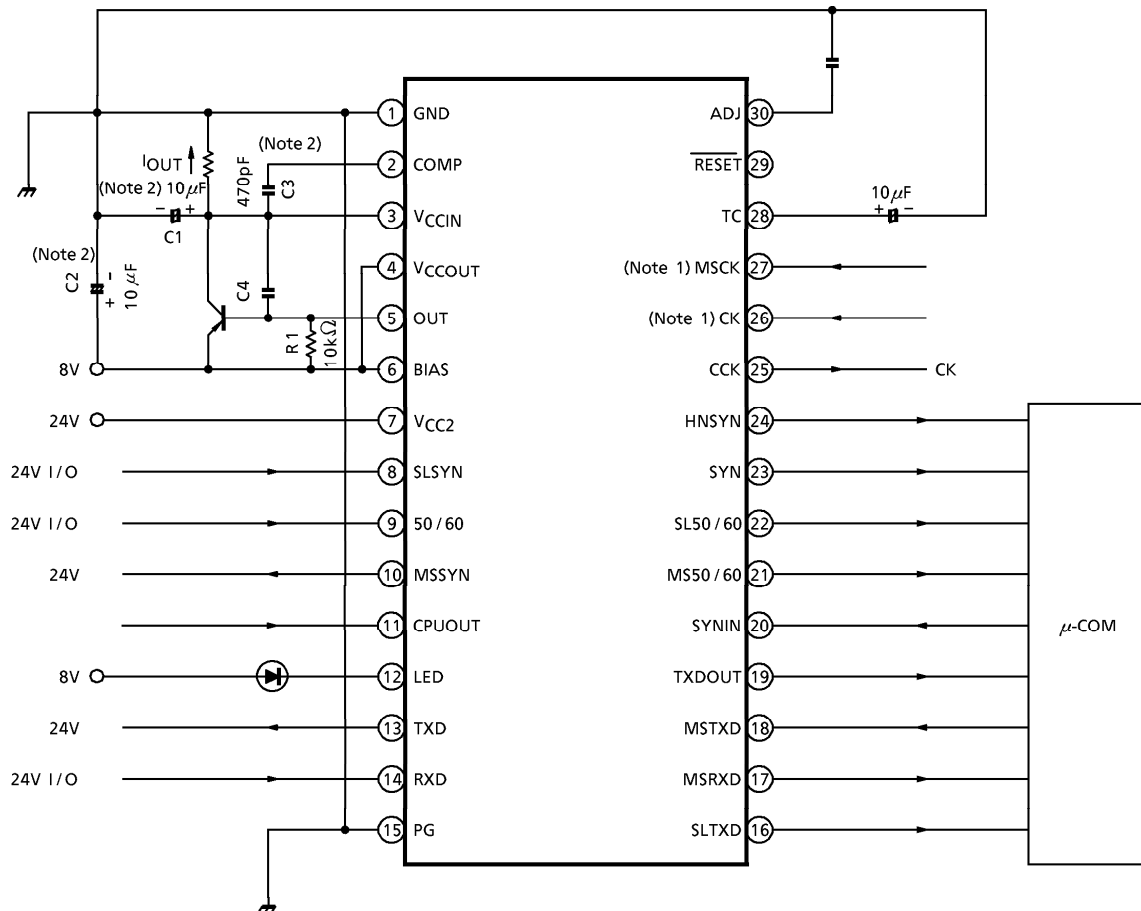
(Note 3) 24-V System : $C_L = 50pF$

(Note 4) 5-V System : $C_L = 50pF$
 $R_L = 5k\Omega$

(Note 5) 5-V System : $C_L = 50pF$

APPLICATION CIRCUIT

When using an external PNP transistor :

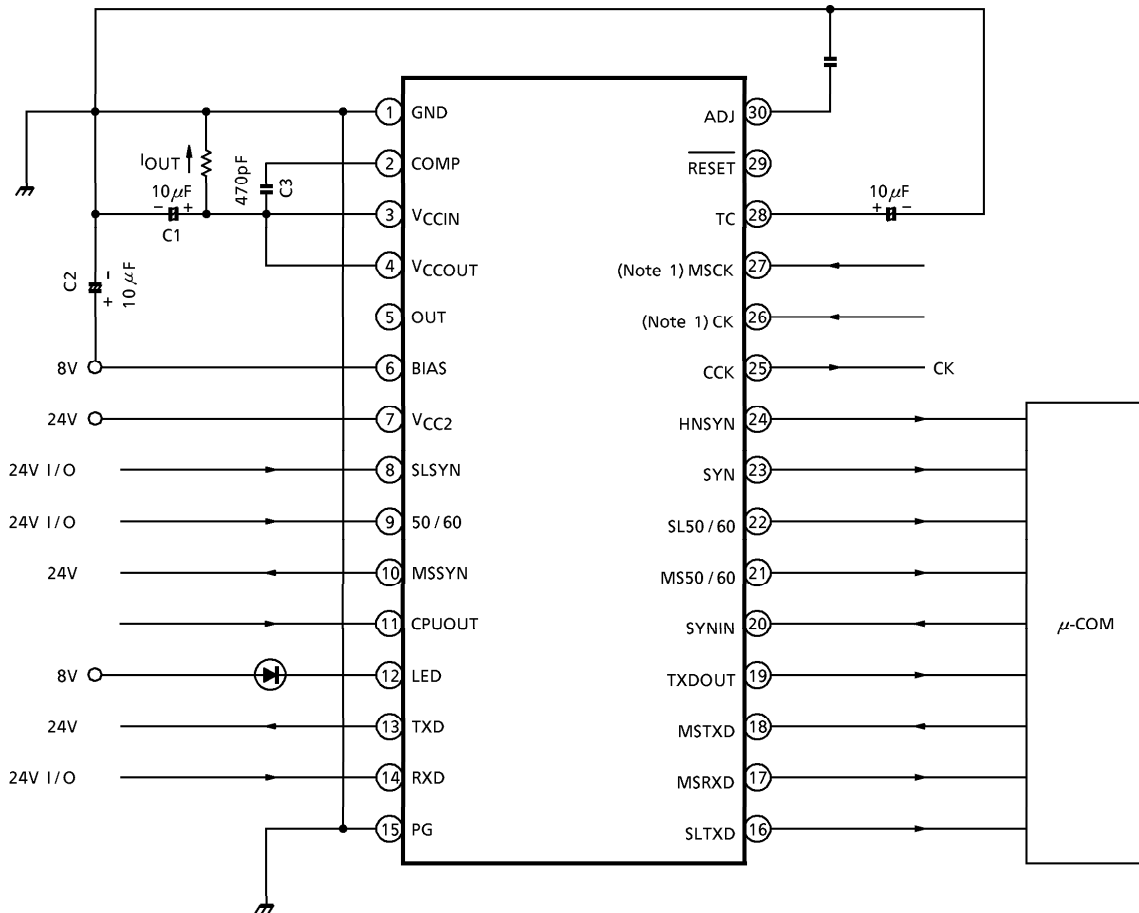


- (Note 1) When using the MSCK pin, short circuit the CK pin with GND.
When using the CK pin, short circuit the MSCK pin with GND.
- (Note 2) C1 and C2 are necessary to absorb external noise, etc. Connect them as close to the IC as possible.
C3 is used for phase correction, but this also must be connected as close to the IC as possible.
We recommend that C4 be connected between OUT and VCCIN.

PRECAUTIONS for USING

Utmost care is necessary in the design of the output line, VCC (VCCIN, VCCOUT, BIAS, VCC2) and GND line since IC may be destroyed due to short-circuit between outputs, air contamination fault, or fault by improper grounding.

When using a built-in PNP transistor :

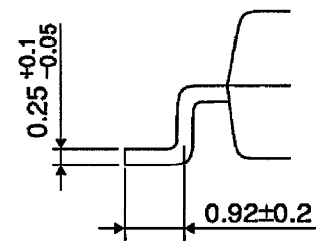
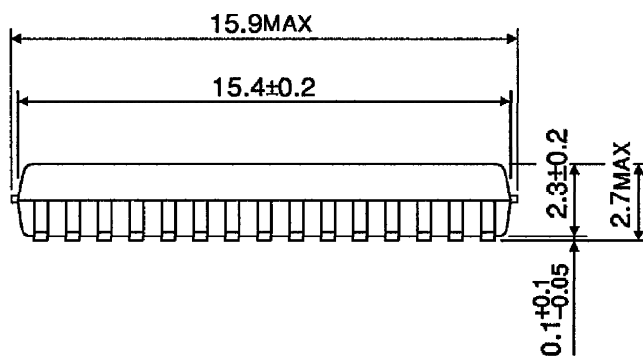
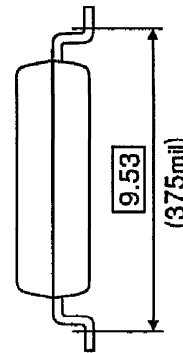
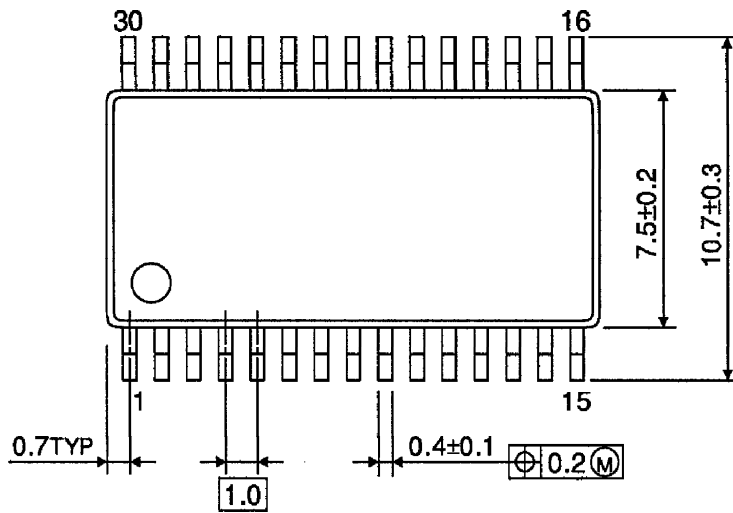


(Note 1) When using the MSCK pin, short the CK pin with GND.
When using the CK pin, short the MSCK pin with GND.

(Note 2) C1 and C2 are necessary to absorb external noise, etc.
Connect them as close to the IC as possible.
C3 is used for phase correction, but this also must be connected as close to the IC as possible.

OUTLINE DRAWING
SSOP30-P-375-1.00

Unit : mm



Weight : 0.63g (Typ.)