U 840 B / U 840 B–FP

Digital/wipe-wash control for rear or front wiper

Features

- Interval-switch A and B to GND
- Wipe/wash push button to V_{bat}
- Output driver protected against short circuit digital debounced: t_6 = 10 ms
- All time periods digital determined by RC-oscillator
- Turn-on time of relay t_2 = 375 ms
- Adjustable interval pause, t_3 = 0.8 s ... 22 s
- Dry wiping time t_5 = 3.7 s
- Program pin PP determines turn-on delay t_4 during wipe-wash mode
  PP to GND: t_4 = 0.8 s
  PP to V_S: t_4 = 0 s
  also t_4 = 0 s in interval mode
- Inputs CP and INT digital debounced, t_1 = 100 ms
- All inputs with integrated RF protection
- Load dump protected and interference protection according to ISO 7637–1/3 (DIN 40839)

Cases

8 pin Dual Inline Plastic (DIP 8) U 840 B

8 pin Small Outline Plastic (SO 8) U 840 B–FP

Functional Block Diagram

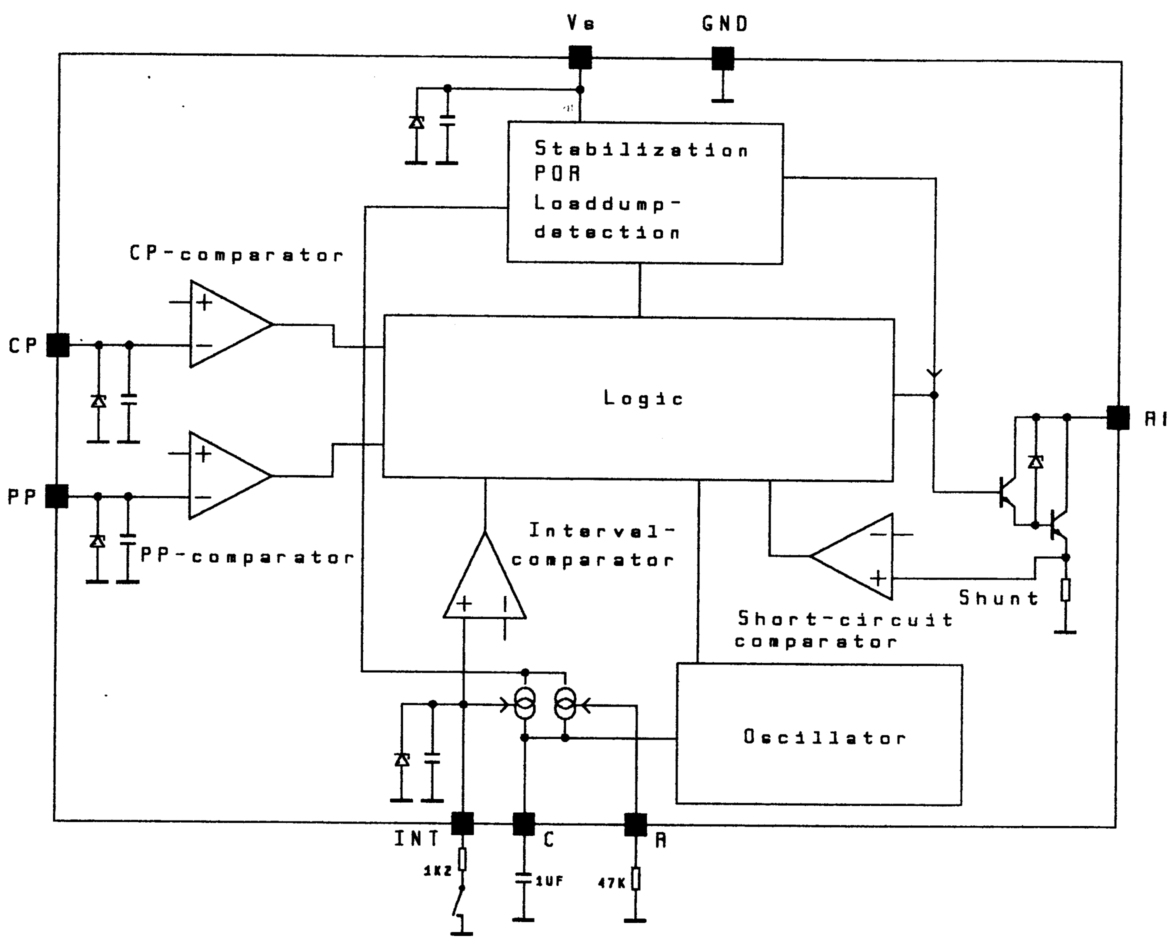


Figure l

The circuit U 840 B (DIP 8) and U 840 B-FP (SO 8) of **TELEFUNKEN electronic** is designed as interval wipe/wash timer for the automotive application.

The interval pause t_3 can be set in a range from 0.8 s ... 22 s by an external 30 kΩ potentiometer. All other time periodes are determined by the basic frequency f_0 of the oscillator. The wipe/wash (WIWA) mode has priority over the interval mode. The program pin PP commits, whether the wiper immediatly starts to wipe, or with a delay time t_4 of 0.8 s.
The inputs CP and INT are digital debounced, the turn on as well as the turn off.

The integrated relay driver is protected against short circuits and is switched to conductive condition in the case of a load dump. The circuit is protected with the recommended external circuitry against load dump and RF interference, refer to ISO 7637–1/3 (DIN 40839).

Basic Circuit

Power Supply

For reasons of interference protection and surge immunity, all circuits must be provided with an RC circuit for current limitation in the event of overvoltages and for buffering in the event of voltage dips at V_S.

Suggested dimensioning: R_4 = l80 Ω C_1 = 47 µF, refer to Figure 2.

Between V_S and GND there is an integrated 14 V Z-diode. The operation voltage is between V_{bat} = 9 V ... 16 V.

The capacitor can be dimensioned smaller, if in the supply is used a diode quad for polarity independence. In this case there is no discharging through R_4 in the event of negative interference pulses, but only a discharging from the self current input of the circuit.
Typical value: 10 µF.

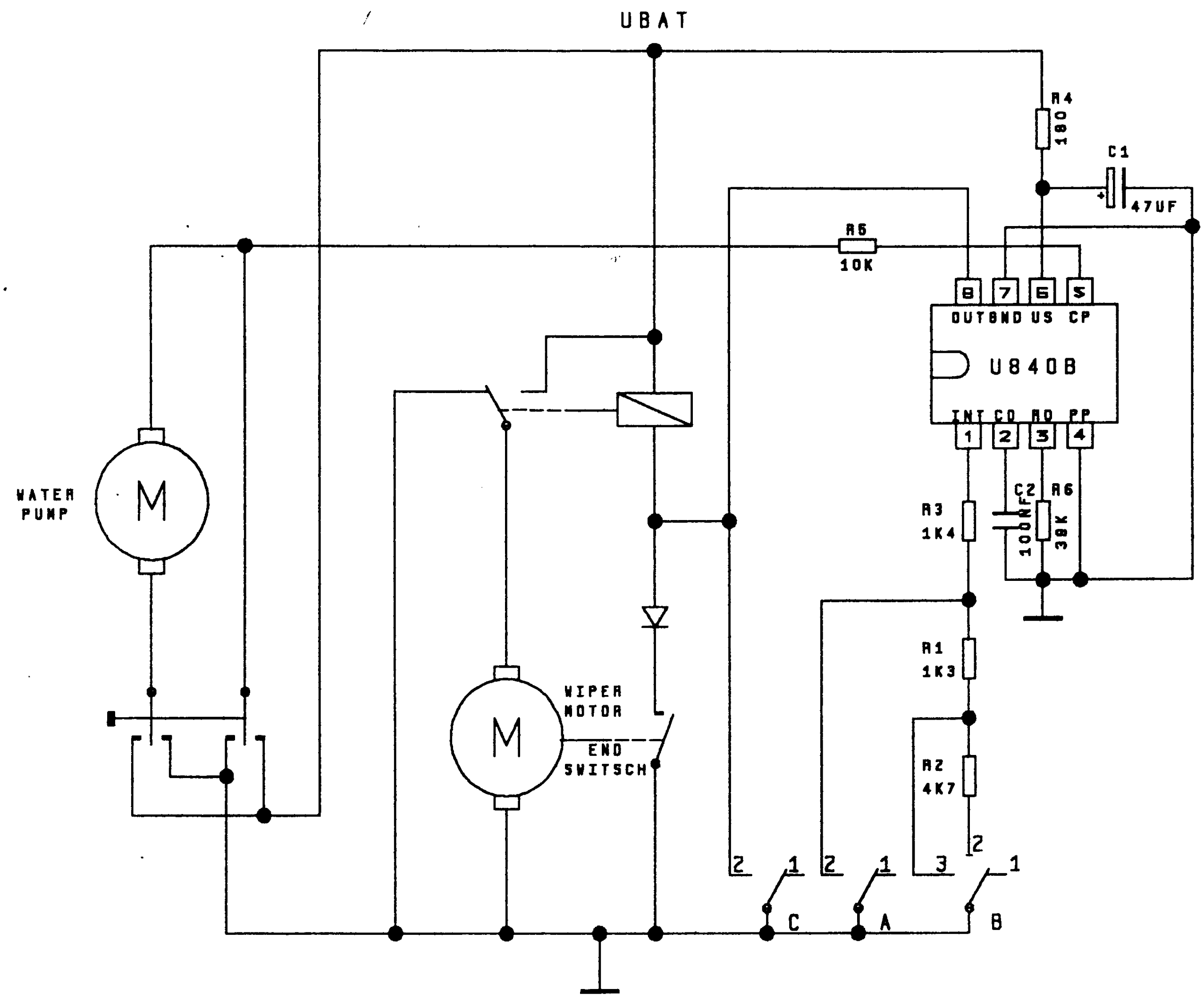


Figure 2 Application circuit with interval and WIWA operation

Oscillator

In the circuit all timing sequences are derived from an RC oscillator who is charged by an internal current source and discharged by an integrated 500 Ω resistor. The basic frequency f_0 is determined by the resistor RO between pin RO and GND and by the capacitance CO between pin CO and GND. The basic frequency is adjusted to 320 Hz (3,125 ms) by R_6 = 39 kΩ and C_2 = l00 nF.

The tolerances and the temperature coefficients of the external devices determine the precision of the oscillator frequency. Suggested is a metallic-film resistor ±l % and a capacitance ±5 % with a TC of a MKT or MKS2 capacitance.

The debouncing time t_1, the turn-on time of the relay t_2, the delay time t_4, the dry wiping time t_5 and the debouncing time t_6 (short circuit detection) depend on the oscillator frequency f_0 as follows:

Debouncing time INT, CP	$t_1 = 24 ... 32 * l/f_0$
Turn-on time relay	$t_2 = 120 * l/f_0$
Interval pause	$t_3 = 296 * 1/f_{int}$
Delay time wipe/wash mode	$t_4 = 256 * l/f_0$
Dry wiping time	$t_5 = 1184 * l/f_0$
Debouncing time SC	$t_6 = 2 ... 3 * 1/f_0$

SC (short circuit) = collector current of relay driver I_C > 500 mA.

The clock counts of the debouncing times are not fixed, because the switching of the signals and the system clock are asynchronous. The cause of the clock count variation is shown by the example of the short circuit debouncing (Figure 3).

The relay output is activated. The internal logic of the IC queries the short circuit detection SC during the positive slope of the system clock CL. A 3-stage shift register is loaded by the positive slope of clock 1, 2 and 3 and the relay output is switched off. A short circuit signal what happened after the positive slope of clock 0 is just recognized by the positive slope of clock l. Therefore the debouncing of the short signal continue two to three clock periods.

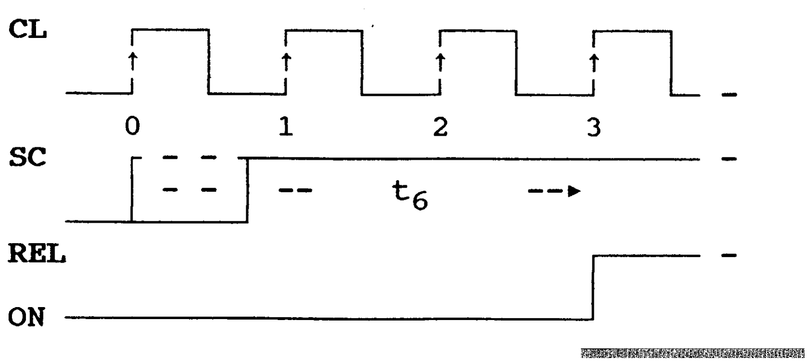


Figure 3 The debouncing of the short circuit detection

These times can be adjusted (except t_3) by variation of the external frequency determined devices. The oscillator frequency is calculated approx. in accordance with the following formula:

$$f_0 \approx 1/(0.832*C_2*(300+R_6))$$

The resistor between the interval switch and pin INT determines the interval pause. During the interval pause the current source is switched, the frequency is determined by the interval resistor. After the end of the interval pause the oscillator switch again to the basic frequency. This procedure allows interval pause times between 0.8 s ... 22 s.

The dependence of the interval pause t_3 from the interval resistor and therefore from the position of the switch A and B is shown in function table l.

CP	B	A	INT	C	OUT	Note
L	1	1	OFF	1	OFF	+V
X	X	X	X	2	ON	OUT C
L	2	1	R_1+R_2	1	INT_1	11 cycle/min
L	3	1	R_1	1	INT_2	27 cycle/min
L	X	2	GND	1	INT_3	44 cycle/min
H	X	X	X	1	WIWA	

Function table 1

Relay Output

The relay output is an open collector Darlington transistor with integrated 28 V Z-diode for limitation of the inductive cut-out pulse of the relais coil. The maximum static collector current must not exceed 300 mA and saturation voltage is typically 1.2 V for a current of 200 mA.

The collector current is permanent measured by an integrated shunt and in the case of a short circuit (I_C > 500 mA) to V_{bat} the relais output is stored disabled.

The backspacing of the short circuit buffer is possible, if the switches interval and wipe/wash are opened. A new try to switch on from INT or CP cause again a switch off of the relay output, if the short circuit still exists, otherwise the normal function is possible.

The short circuit detection is digital debounced about a period from l0 ms, so that shorter interference peaks at the power supply don’t disable the output transistor, because the interference peaks cause a higher current and pretend a short circuit.

During a load dump impuls the output transistor is switched to conductive condition to prevent a destruction. The short circuit detection is suppressed during the load dump.

Interference Voltages and Load Dump

The IC supply is protected by R_4, C_1 and an integrated Z-diode, the inputs are protected by a series resistor, integrated 14 V Z-diode and RF capacitor.

The RC-configuration stabilizes the supply of the circuit during negative interference voltages, so that the POWER-ON-RESET (POR) doesn’t arise and reset the function of the circuit.

The relay output is protected against short interference peaks by an intergrated 28 V Z-diode, and during load dump the relais output is switched to conductive condition for a battery voltage of greater than approx. 30 V. The output transistor is dimensioned so that it can absorb the current, produced by the load dump pulse.

Power-On-Reset

When the operating voltage is switched on, an internal power-on-reset pulse (POR) is generated which sets the logic of the circuits to defined intinial condition. The relay output is disabled, the short circuit buffer is reseted.

Functional Description

Interval Function

By closing the interval switch A and/or B to GND (refer to function table l) for a time longer than the debouncing time t_1 = l00 ms the relay is activated for a time t_2 = 375 ms, after it the interval pause begins. The oscillator switches to a frequency, which is determined by (R_1 ... R_3). At the end of the interval pause t_3 the relay is activated for a time t_2.

If during the turn-on time of the relay the switches A and B are opened (also the opening is debounced), then the time t_2 runs off, one turn of the wiper arm is finished. After it the interval mode can be immediatly activated.

The resistor between the interval switch and pin INT determines the interval pause. The circuit U 840 B is so dimensioned, that a linear resistor-time-characteristic is used. Therefore a doubling of the resistor evokes a double so long interval pause. With the help of the resistor R_3 the characteristic can be shifted parallel to its axis. The resistors R_1 and R_2 keep their values.

An increasing of R_3 shifts the characteristic to longer interval pauses. With it the interval pause can be adjusted to the demanded values by the dimensioning of R_3. The resistor R_3 must be not smaller than l kΩ, otherwise the linearity of the resistor-time-characteristic can’t be guaranteed and a too great current flows from the input INT to GND.

Wipe/Wash Releasing and Program Pin PP

After operating the wash button the relais is activated after the debouncing (pin PP connects to V_S). As long as the button is pushed, water is sprayed on the windscreen by the water pump. After releasing the wash button, after 100 ms reverse debouncing, the dry wiping time t_5 begins to start. At the end of the dry wiping time the relay is disabled.

The input PP is connected to ground, the debouncing time of the WIWA mode is extended for 800 ms. The water is sprayed on the windscreen, before the wiper begins its job.

PP to GND: 0.8 s delay time

PP to V_S: 0.1 s delay time

Interval Wipe/Wash Mode

The interval function is interrupted when the wash button is operated. In this case the 0.8 s delay time t_4 is reduced to the 100 ms debouncing time. Interval function begins after the wipe/wash function is over.

Switch Contact Currents

The contact current of the interval switch is 0.6 mA ... 3 mA. Of course the current depends on the position of the interval switches. The contact current of the wash button is fixed by the internal resistance of the water pump. A pull-down resistor is integrated at the input CP. Therefore the input is connected to ground in the case of an open wash push button and a not connected pump.

Input Leakage Resistance

With a resistor more than 40 kΩ between INT to GND the interval function isn’t activated.

The wipe/wash function isn’t activated by a leakage resistance > 10 kΩ and recommended external circuitry.

Absolute Maximum Ratings

Parameters		Symbol	Value	Unit
Supply Voltage	t = 60 s t = 1 h	V_{bat} V_{bat}	24 18	V V
Ambient temperature range		T_{amb}	–40 ... +100	°C
Storage temperature range		T_{stg}	–55 ... +125	°C
max. junction temperature		T_J	150	°C
Thermal resistance	DIP 8 SO 8	R_{thJA} R_{thJA}	110 160	K/W K/W

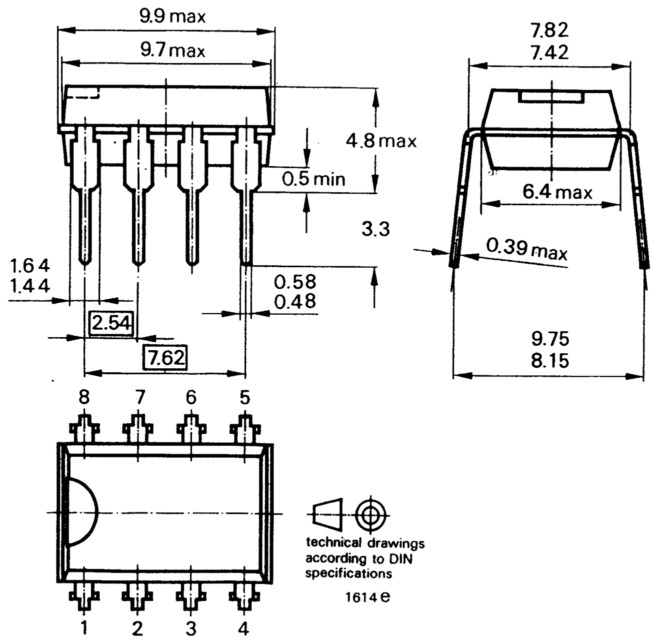
Electrical Characteristics

V_{bat} = 13.5 V, T_{amb} = 25 °C, reference point ground (PIN 7) circuit with recommended external circuitry

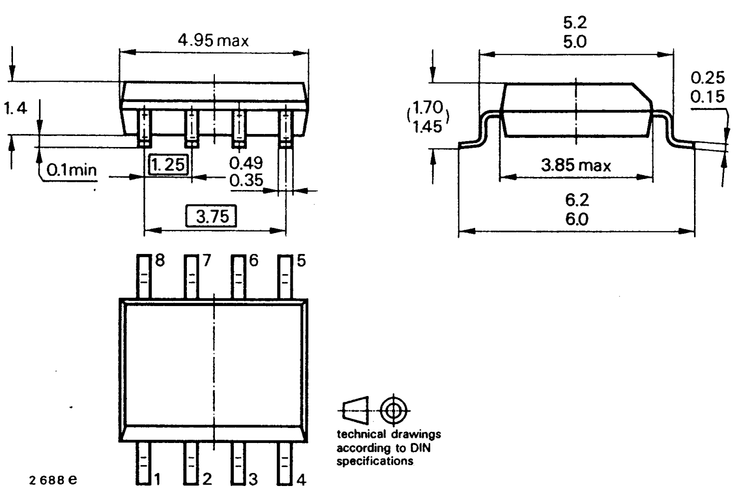
Parameters	Test Conditions / Pin	Symbol	Min	Typ	Max	Unit
Supply						
Supply voltage range		V_{bat}	9		16	V
Supply current, all push buttons open		I_6			3	mA
Undervoltage threshold POR		V_6		4		V
Series resistance		R_V		180		Ω
Filter capacitance		C_S		47		µF
Internal Z-diode		V_6		14		V
INT-input (Pin 1)						
Protective diode		V_1		14		V
Internal capacitance		C_1		25		pF
External resistance		R_{INT}	1			kΩ
Leakage resistance		R_L	40		60	kΩ
PP-input (Pin 4)						
Protective diode		V_4		14		V
Internal capacitance		C_4		13		pF
Threshold		V_4		0.5 * V_S		V
Pull-down resistance		R_4		120		kΩ
CP-input (Pin 5)						
Protective diode		V_5		14		V
Internal capacitance		C_5		25		pF
Threshold		V_5		0.5 * V_S		V
Leakage resistance		R_L		10		kΩ
Pull-down resistance		R_5		20		kΩ
Relais output with limitation of short circuit current (Pin 8)						
Saturation voltage 100 mA		V_8		1.0		V
Saturation voltage 200 mA		V_8		1.2		V
Relais coil resistance		R_{REL}	60			Ω

Parameters	Test Conditions / Pin	Symbol	Min	Typ	Max	Unit
Output current Normal operation		I_8			300	mA
Output pulse current Load dump		I_8			1.5	A
Internal Z-diode		V_8		28		V
Short circuit threshold		I_8	500			mA
Oscillator input						
Oscillator capacitance (Pin 2) (± 5 %, TC MKT, MKS2)		C_2		100		nF
Oscillator resistance (Pin 3) (± 1 % TC)		R_6		39		kΩ
Oscillator frequency		f_0		320		Hz
Upper switching point		V_2		3		V
Lower switching point		V_2		1		V
Internal discharge Resistance		R_2		500		Ω
Times External circuitry see Oscillator input						
Debouncing time CP, INT		t_1	67		110	ms
Interval turn-on time		t_2	300		450	ms
Interval pause		t_3	0.8		22	s
Turn-on delay Wipe/wash mode, PP to GND		$t_4 + t_D$	800		1000	ms
Dry wiping time		$t_5 + t_D$	3400		4200	ms
Debouncing time short circuit		t_6	6		11	ms
t_D = debouncing time						
1. Interval cycle time		$t_2 + t_{3,1}$	1200		1500	ms
2. Interval cycle time		$t_2 + t_{3,2}$	1980		2450	ms
1. Interval cycle time		$t_2 + t_{3,3}$	4900		6100	ms

Dimensions in mm



Case:
DIP 8



Case:
SO 8

OZONE DEPLETING SUBSTANCES POLICY STATEMENT

It is the policy of **TEMIC TELEFUNKEN microelectronic GmbH** to

1. Meet all present and future national and international statutory requirements and

2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

Of particular concern is the control or elimination of releases into the atmosphere of those substances which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) will soon severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

TEMIC TELEFUNKEN microelectronic GmbH semiconductor division has been able to use its policy of continuous improvements to eliminate the use of any ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively

2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA and

3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

TEMIC can certify that our semiconductors are not manufactured with and do not contain ozone depleting substances.

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