

Low-Voltage Electronic Speech Circuit with Dialer Interface

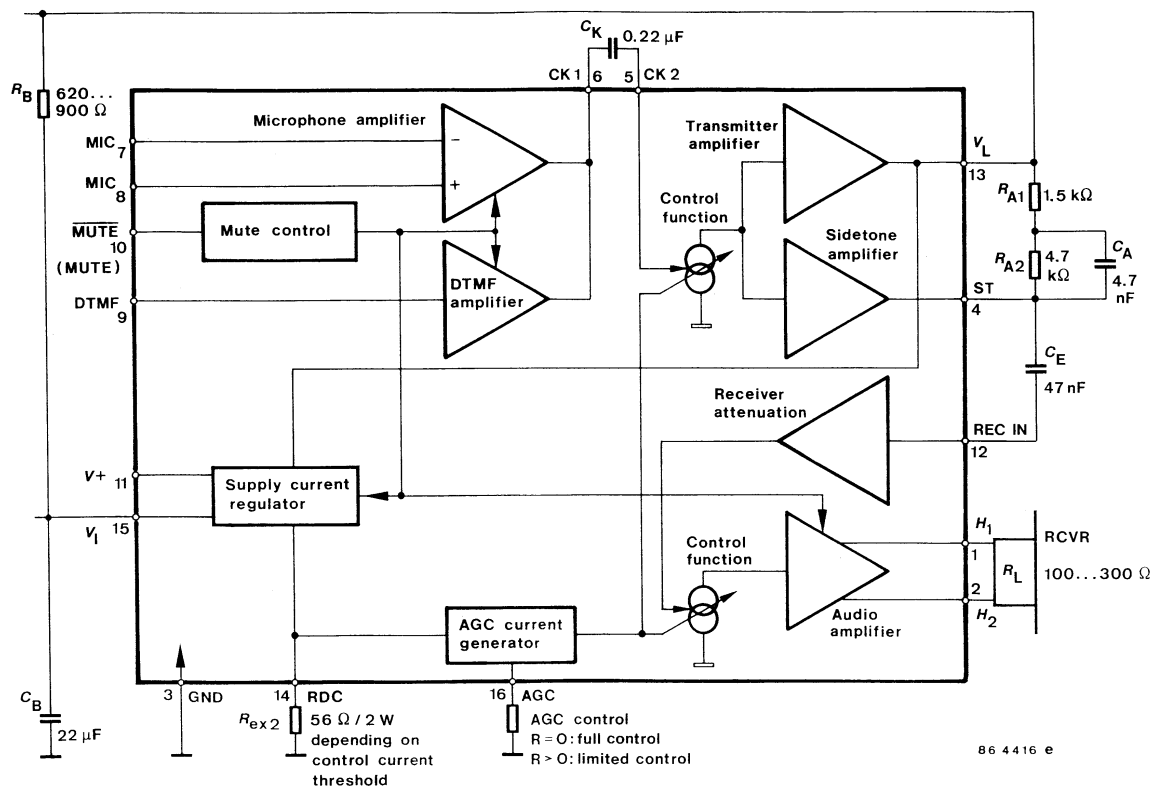
Description

The U4055B electronic speech circuit is a linear integrated circuit for use in telephone and other line fed terminal equipment. It replaces the common speech circuit with carbon microphone, hybrid transformer,

sidetone equivalent and ear protection rectifiers. A low-cost electrodynamic transducer is used as the earphone. It contains all components necessary for amplification of signals and adaption to the line.

Features

- An electronic circuit replaces the microphone hybrid transformer
- Symmetrical input for dynamic or piezo microphone
- High performance through the use of dynamic transducers as the earphone (non-linear distortion $\leq 2\%$)
- Automatic line loss compensation
- DTMF interface with muting
- Supply voltage for dialer
- High range of line feeding current
- Input resistance independent of line current and sidetone suppression circuit.
- Built-in ear protection by earphone voltage limiter
- Operation possible from 8 mA



U4055B1: High level mute; **U4055B:** Low level mute

Figure 1. Block diagram and pin connection

Pin Description

| Pin | Symbol | Function |
|------|-----------------------------------|---|
| 1, 2 | H ₁ and H ₂ | The push-pull complementary outputs of the receive amplifier. Dynamic transducers with a minimum impedance of 100 Ω can be directly driven by these outputs. |
| 3 | GND | Ground. |
| 4 | ST | The output of the sidetone cancellation signal, which requires a balanced impedance of 8–10 times the subscribers line impedance to be connected to Pin 13. |
| 5 | CK2 | Input to the line output driver amplifier. Transmit a.g.c. applied to this stage. |
| 6 | CK1 | The transmit pre-amp output respective of the DTMF output which is normally capacitively coupled to Pin 5. |
| 7, 8 | MIC 1, MIC 2 | Inputs of symmetrical microphone amplifier with high common mode rejection ratio. |
| 9 | DTMF IN | The DTMF input has an internal resistor connected to ground. It provides the load resistor for the emitter of a CMOS DTMF generator. This input is only active when MUTE (Pin 10) is pulled high or MUTE is pulled low. |
| 10 | MUTE or $\overline{\text{MUTE}}$ | The MUTE input must be pulled at least at 1.5 V (MUTE) or at less than 0.5 V ($\overline{\text{MUTE}}$) to mute the MIC Amp. and Audio Amp. and enable DTMF IN. |

| Pin | Symbol | Function |
|-----|------------------|---|
| 11 | V+ | Regulated output voltage of 2.7 V for biasing a DTMF generator activated by MUTE. |
| 12 | REC IN | The receive amplifier input. The receiving amplification is regulated of an a.g.c. |
| 13 | V _L | Positive supply voltage input to the device. This input should be connected to the positive output of the polarity guard. The current through this pin is modulated by the transmit signal. |
| 14 | R _{DC} | An external resistor (2 W) is required from this pin to GND to control the dc input impedance of the circuit. It has a nominal value of 56 Ω for low voltage operation. Values up to 100 Ω may be used to increase the available transmit output voltage swing at the expense of low-voltage operation. |
| 15 | V _I | This internal voltage bias line must be connected to V _L via an external resistor, R _B , which dominates the ac input impedance of the circuit and should be 620 Ω for an 600 Ω input impedance or 910 Ω for a 900 Ω input impedance. |
| 16 | R _{AGC} | The range of transmit and receive gain variations between short and long loops may be adjusted by connecting a resistor R _{EX1} from this pin to Pin 3 (GND). This pin can be left open to set a.g.c. out of action. |

Pin Connection

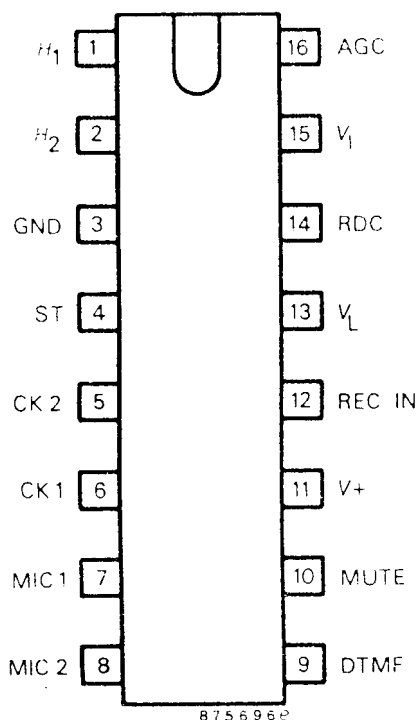


Figure 2.

Absolute Maximum Ratings

Reference point Pin 3, unless otherwise specified.

| Parameters | Symbol | Value | Unit |
|-----------------------------------|-----------------|-------------|------|
| Line current | I_L | 200 | mA |
| DC line voltage, $t_p = 3$ ms | Pin 13 V_L | 20 | V |
| Power dissipation, $I_L = 100$ mA | P_{tot} | 560 | mW |
| Junction temperature | T_j | 150 | °C |
| Ambient temperature range | T_{amb} | -28 to +80 | °C |
| Storage temperature range | T_{stg} | -55 to +150 | °C |

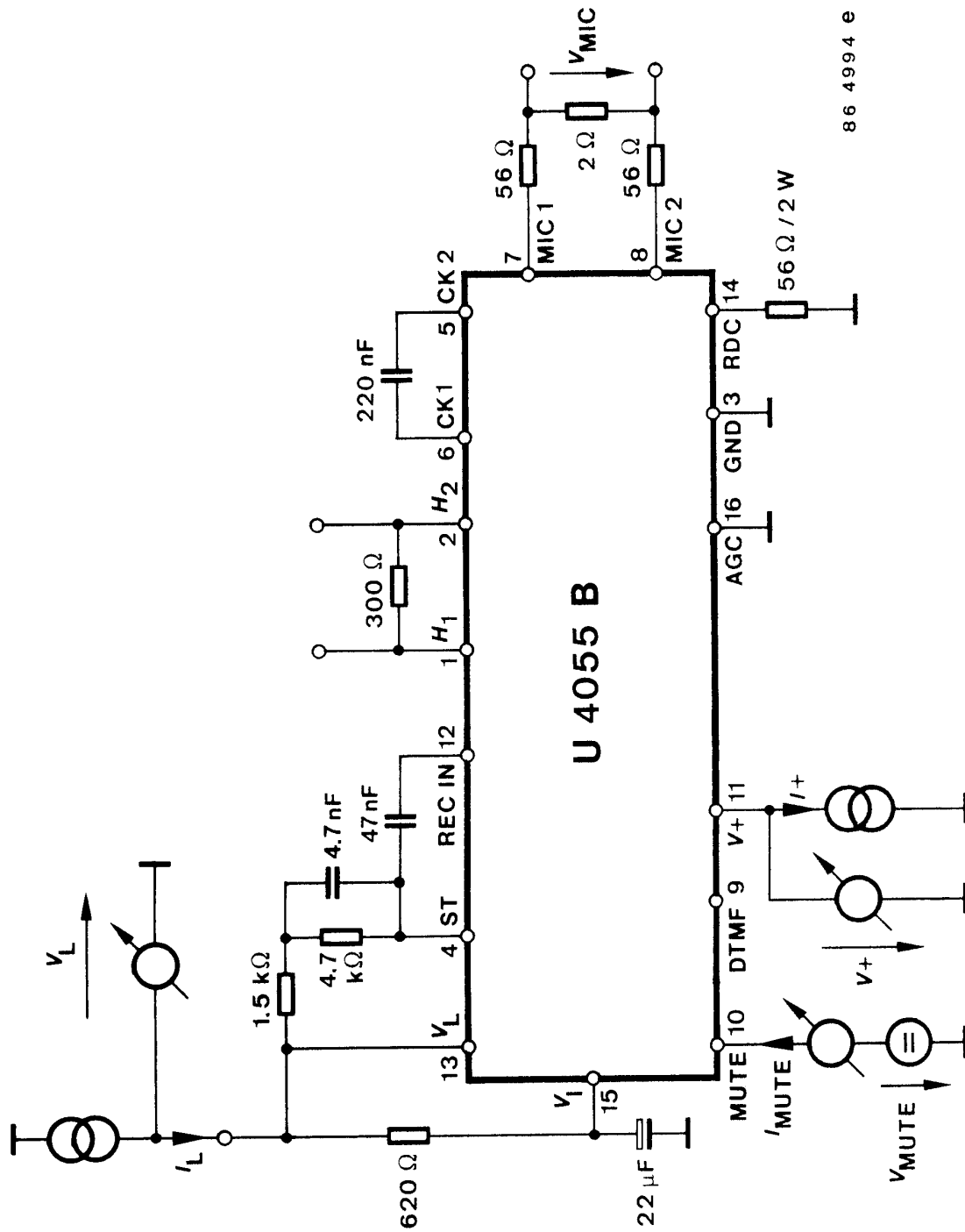
Thermal Resistance

| Parameters | Symbol | Value | Unit |
|------------------|------------|-------|------|
| Junction ambient | R_{thJA} | 85 | K/W |

Electrical Characteristics

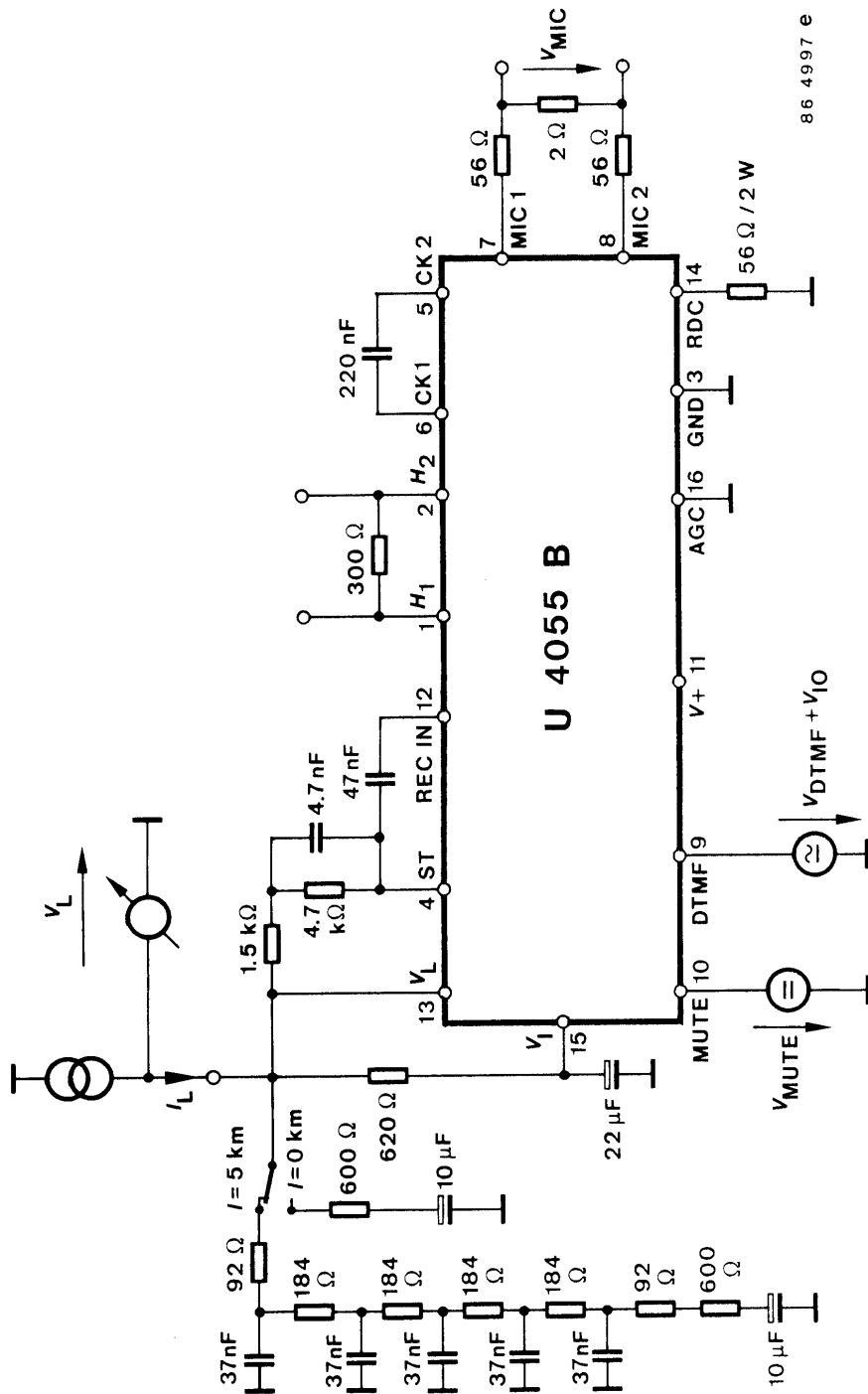
Reference point Pin 3, cable equivalent = $l = 1 \text{ km}$, $\varnothing 0.5 \text{ mm}$, $R' = 184 \Omega$, $C' = 37 \text{ nF}$, $f = 1300 \text{ Hz}$, $0 \text{ dBm} = 775 \text{ mV}_{\text{rms}}$, $R_{\text{DC}} = 56 \Omega / 2 \text{ W}$, $T_{\text{amb}} = 25^\circ\text{C}$, unless otherwise specified.

| Parameters | Test Conditions / Pins | Symbol | Min. | Typ. | Max. | Unit |
|---|--|-------------------|------|------|------|------------------|
| Line voltage | $I_L = 8 \text{ mA}$ | V_L | 1.8 | 2.1 | 2.6 | V |
| | $I_L = 20 \text{ mA}$ | | 3.0 | 3.3 | 3.6 | V |
| | $I_L = 30 \text{ mA}$ | | 3.6 | | 4.5 | V |
| | $I_L = 73 \text{ mA}$, see figure 4 | | 7.7 | | 9.7 | V |
| Transmit and sidetone see figure 5 | | | | | | |
| Input resistance | Pin 7 - 8 | R_i | 7 | 10 | 13 | k Ω |
| Gain | $I_L = 30 \text{ mA} = l = 5 \text{ km}$ adjustable with R_{AGC} $I_L = 30 \text{ to } 73 \text{ mA} \cong l = 5 \text{ km to } 0 \text{ km}$ | G_s | 57 | 59 | 61 | dB |
| | | ΔG_s | -7 | | -9 | dB |
| Noise at line weighted psophometrically | $I_L = 73 \text{ mA} \cong l = 0 \text{ km}$ $V_{\text{MIC}} = 0 \text{ V}$ | n_o | | -70 | -68 | dBm |
| Sidetone reduction | $I_L \cong 20 \text{ mA}$ | G_{STA} | 10 | 15 | 20 | dB |
| DTMF-Amplifier see figure 6 | | | | | | |
| Input resistance | Pin 8 - 3 | R_D | 8 | 10 | 13 | k Ω |
| DTMF Gain | $I_L = 30 \text{ mA} \cong l = 5 \text{ km}$ $R_{\text{ex1}} = 0$ adjustable with R_{ex1} $I_L = 31 \text{ mA to } 78 \text{ mA} = l = 5 \text{ km to } 0 \text{ km}$ | G_D | 9 | | 13 | dB |
| | | ΔG_D | -7 | | -9 | dB |
| Volume range $d \cong 5\%$ | | V_0 | 1 | | | V_{RMS} |
| Receiving amplifier see figure 4 | | | | | | |
| Input resistance | Pin 12 - 3 | R_i | | 50 | | k Ω |
| Gain | $R_{\text{HH}} = 300 \Omega$, $I_L = 30 \text{ mA} \cong l = 5 \text{ km}$ $R_{\text{HH}} = 300 \Omega$ adjustable with R_{AGC} , $I_L = 31 \text{ mA to } 78 \text{ mA}$ $l = 5 \text{ km to } 0 \text{ km}$ | G_R | -1 | -3 | -5 | dB |
| | | ΔG_R | -5 | -6 | -7 | dB |
| Receiving noise at earphone weighted psophometrically | $I_L = 78 \text{ mA} = l = 0 \text{ km}$ $S_2 = 0$ | n_i | | -80 | -71 | dBm |
| Gain change when muted | $I_L \cong 20 \text{ mA}$ | G_{RM} | 15 | 20 | 24 | dB |
| Output saturation threshold | $I_L \cong 20 \text{ mA}$ | V_0 | 0.8 | 1 | 1.5 | V_{pp} |
| MUTE or MUTE-input | | | | | | |
| MUTE-input current | Pin 9 = 0 V | $\overline{I_M}$ | 20 | 50 | 80 | μA |
| MUTE off input voltage | | V_{Moff} | 1.5 | | | V |
| MUTE on input voltage | | V_{Mon} | | | 0.3 | V |
| MUTE-input current | Pin 9 = 1.5 V | I_M | 10 | 20 | 30 | μA |
| MUTE off input voltage | | V_{Moff} | | | 0.3 | V |
| MUTE on input voltage | | V_{Mon} | 1.5 | | | V |
| Supply voltage see figure 4 | | | | | | |
| Output voltage | $I_L \cong 20 \text{ mA}$ MUTE or MUTE switched off switched on Pin 10 | V_+ | 3 | | 6.1 | V |
| | | | 2.5 | 2.9 | 3.1 | V |
| Output current | $I_L \cong 20 \text{ mA}$ MUTE or MUTE switched off switched on Pin 10 | I_+ | | | 30 | μA |
| | | | 1 | | | mA |



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Figure 4. Line and supply voltage characteristics



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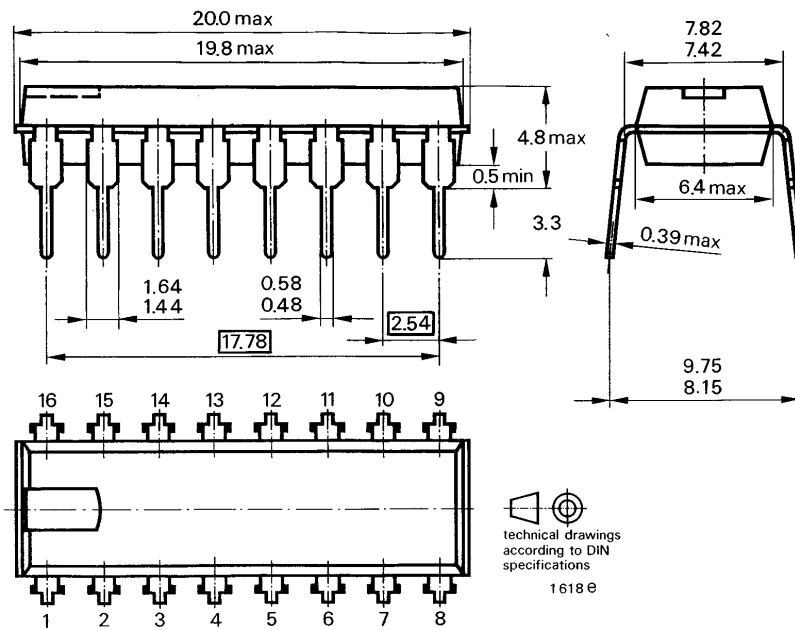
Volume range
 (dB $\leq 5\%$) min $V_O = 850 \text{ mV}_{\text{rms}}$
 $G_D = 20 \log \frac{V_L}{V_{\text{DTMF}}}$

Figure 6. DTMF amplifier

Ordering Information

| Extended Type Number | Package | Remarks |
|----------------------|---------|-----------------|
| U4055B1 | DIP16 | High level mute |
| U4055B | DIP16 | Low level mute |

Dimensions in mm



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.
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.

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

The Montreal Protocol (1987) and its London Amendments (1990) intend to 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 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
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 ozone depleting substances and do not contain such substances.

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