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Features

- **5-V Supply Voltage**
- **Gain-controlled 3-stage Wide-band IF Amplifier**
- **Active Carrier Generation by FPLL Principle (Frequency-Phase-Locked-Loop) for True Quadrature Demodulation**
- **Complete Alignment-free AM Demodulator**
- **Switchable Amplitude Detector for Gain Control, which Operates as a Peak Detector for FM Sound and as a Mean Level Detector for AM Sound**
- **Pb-free Package, which is Compliant with Requirements of RoHS**

Pb Lead Free

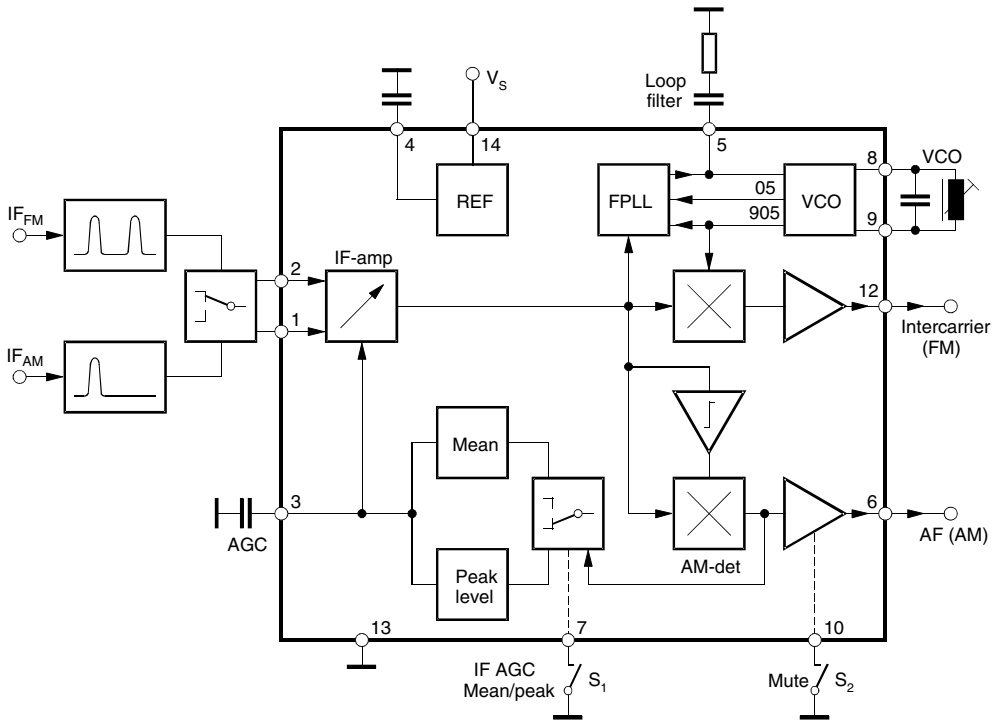
Quasi-split Sound Circuit and AM Demodulator IC

U4468B

1. Description

The U4468B is an integrated bipolar circuit for full multistandard sound IF signal processing in TV/VTR and multimedia applications. It supplies AM signals as well as FM/NICAM sound IF signals and thus allows the design of a universal sound IF module for various applications.

Figure 1-1. Block Diagram



Rev. 4777B–TVVCR–07/05

2. Circuit Description

2.1 IF Amplifier and AGC

The symmetrical IF input signal from the external SAW filter is fed to the pins 1 and 2. In case of FM/NICAM applications, a SAW filter with double band-pass characteristic is required for the vision and sound carrier. In case of the L-standard, a band-pass filter with the center frequency at the L-sound carrier is used.

The amplifier consists of three AC-coupled wide-band IF stages. Each differential amplifier stage is gain controlled by the AGC (Automatic Gain Control) voltage, available at pin 3. The output signal of the IF amplifier is then applied to the FPLL carrier generation, to the mixer for FM/NICAM signals and to the AM demodulator.

The IF-AGC is derived from the average level of the AM carrier (L-standard) or from the peak value of the FM carrier (e.g., B/G standard). It controls the three-stage wide-band amplifier to provide a constant SIF signal to the AM demodulator or to the QSS (quasi-split sound) mixer.

2.2 Standard Switch

If the standard switch (pin 7) is in position “low” (for AM sound), the AGC is operating as an average level detector. In position “open” or “high” (for FM/NICAM sound), the AGC acts as a peak value detector.

2.3 Internal Voltage Stabilizer

The internal band gap reference voltage (4.25V at pin 4) ensures constant performance, independent of supply voltage and temperature.

2.4 FPLL, VCO

The FPLL (frequency-phase-locked loop) circuit consists of a frequency detector and a phase detector to generate a control voltage for the VCO tuning. In locked mode, the VCO is controlled by the phase detector while in unlocked mode, the frequency detector is superimposed. The VCO operates with an external resonance circuit (L and C parallel) and is controlled by integrated varicaps.

A practicable VCO alignment of the external coil is the adjustment of the loop filter voltage (pin 5) to 2.3 V. At this value, the capture and hold range are centered.

2.5 AM Demodulator

The alignment-free AM demodulator is realized by a synchronous detector. The modulated IF signal from the wide-band IF amplifier output is multiplied in phase with the limited SIF signal to remove the AM. Then, the resulting AF signal of the demodulator output is fed to the output amplifier and to the AGC stage.

2.6 Quasi-Split-Sound (QSS) Mixer

The QSS mixer is realized by a multiplier circuit. The IF signal (FM/NICAM) is converted to the intercarrier frequency by means of a quadrature signal from the generated picture carrier provided by the PLL. The intercarrier signal is fed via an output amplifier to pin 12.

2.7 Mute Switch

The AM sound output (pin 6) can be muted by switching the pulling mute switch (pin 10) to “low”.

3. Pin Configuration

Figure 3-1. Pinning DIP16

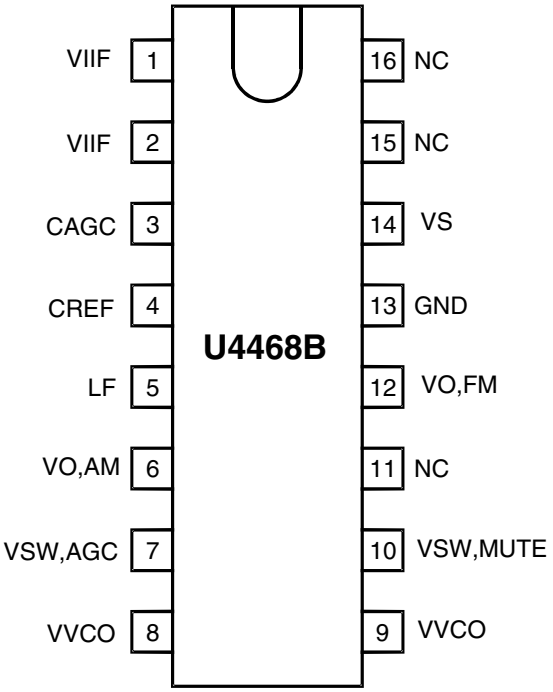


Table 3-1. Pin Description

Pin	Symbol	Function
1, 2	VI,IF	IF input (symmetrical)
3	CAGC	Capacitor for the AGC time constant
4	CREF	Capacitor for the internal reference voltage
5	LF	Loop filter
6	VO,FM	AF output (AM sound)
7	VSW,AGC	Standard switch
8, 9	VVCO	VCO circuit
10	VSW,MUTE	Mute switch
12	VO,FM	Intercarrier output (FM sound)
13	GND	Ground
14	VS	Supply voltage (5V)
11, 15, 16	NC	Not connected

4. Absolute Maximum Ratings

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Reference point pin 13, unless otherwise specified.

Parameters	Pin	Symbol	Value	Unit
Supply voltage range	14	V_s	4.5 to 9.0	V
Supply current	14	I_s	55	mA
Power dissipation (V_S = 9 V)		P	500	mW
Output currents	6, 12	I_{out}	5	mA
External voltages	1-4, 6, 12	V_{ext}	+4.5	V
	5, 8, 9		+3.5	V
	7, 10		V_s	V
Junction temperature		T_j	+125	°C
Operating temperature range		T_{amb}	0 to +85	°C
Storage temperature		T_{stg}	–25 to +125	°C
Electrostatic handling[1]	All	V_{ESD}	±300	V

Note: 1. Equivalent to discharging a 200-pF capacitor through a 0-Ω resistor

5. Thermal Resistance

Parameters	Symbol	Value	Unit
Junction ambient when soldered to PCB	R_{thJA}	60	K/W

6. Electrical Characteristics

V_S = +5V, T_{amb} = +25°C; reference point pin 13, unless otherwise specified.

Parameters	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
DC Supply (Pin 14)						
Supply voltage		V_S	4.5	5.0	9.0	V
Supply current	V_{in} =10 mV or V_3 = 2V	I_S		40		mA
IF Input (Pins 1, 2)						
Minimum IF input signal	Output signal: –3 dB	v_{in}		50		μV_{rms}
Maximum IF input signal	Output signal: +1 dB	v_{in}	70	100		mV_{rms}
Input impedance	(1)	R_{in}		1.2		kΩ
Input capacitance	(1)	C_{in}		2		pF
SIF-AGC (Pin 3)						
IF gain control range		G_v	60	65		dB
AGC capacitor		C_{AGC}		4.7		µF
FPLL and VCO (Pins 5, 8, and 9)						
Maximum oscillator frequency	For carrier generation	f_{VCO}	70			MHz
Vision carrier capture range	f_{VCO} = 38.9 MHz C_{VCO} = 6.2 pF	Δf_{cap}	±1.5	±2		MHz
Oscillator drift (free running) as function of temperature	ΔT_{amb} = 55°C, f_{VCO} = 38.9 MHz C_{VCO} = 6.2 pF(2)	$\Delta f/\Delta T$			–0.3	%
Standard Switch (Pin 7)						
Switching voltage for mode 1: FM/NICAM sound	Peak value control(3)	V_{sw1}	2.0		V_S	V
Switching voltage for mode 2: AM sound	Average level control	V_{sw2}	0		1.5	V
Switching current		I_{sw}		±100		µA
AM Mute Switch (Pin 10)						
Switching voltage	AM output active	V_{mute1}		open		
Switching voltage	AM output switched off	V_{mute2}	0		1.5	V
Switching current		I_{mute}		–100		µA
Intercarrier Output (Pin 12)(4)						
DC output voltage		V_{DC}		2		V
Output resistance	(1)	R_{out}			200	Ω
Intercarrier output signal	v_{in} = 10 mV 5.5 MHz output signal	V_{out}	100	150		mV_{rms}
Intercarrier bandwidth	–1 dB –3 dB	B		TBD TBD		MHz MHz

Notes:
1. This parameter is given as an application information and is not tested during production.
2. The oscillator drift is related to the picture carrier frequency, with an external temperature-compensated LC circuit.
3. Without external control voltage (pin 7 open), the IC automatically operates in mode 1.
4. Picture carrier PC = 38.9 MHz; sound carrier SC_1 = 33.4 MHz, SC_2 = 33.16 MHz; PC/SC_1 =13 dB; PC/SC_2 = 20 dB; PC unmodulated (equivalent to sync peak level).
5. Sound carrier SC = 32.4 MHz, modulated with f_{mod} = 1 kHz, m = 54%; v_{in} = 10 mV.

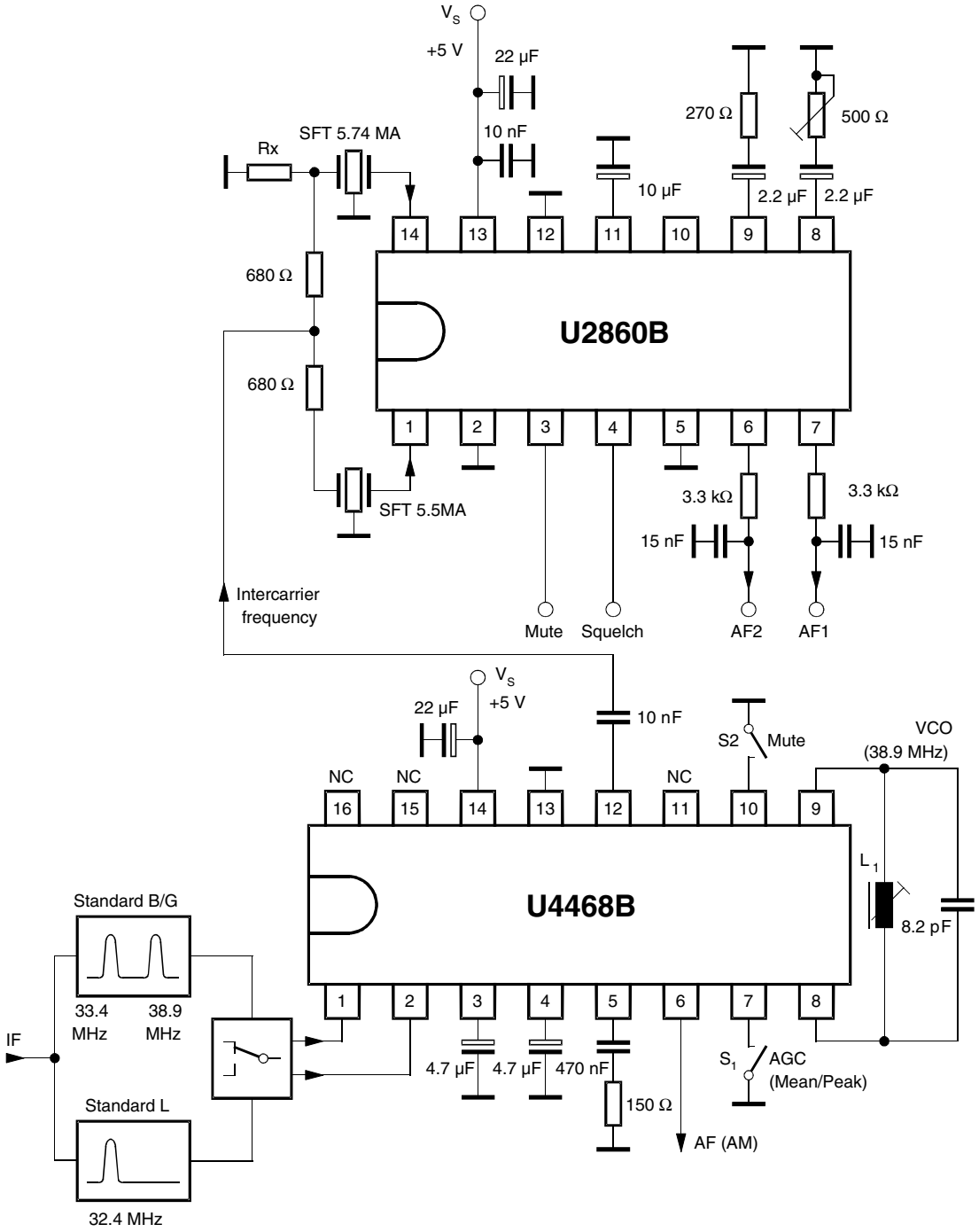
6. Electrical Characteristics (Continued)

V_S = +5V, T_{amb} = +25°C; reference point pin 13, unless otherwise specified.

Parameters	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Weighted signal-to-noise ratio (CCIR 468)	B/G mod. VIF signal: v_{in} =10 mV FM deviation = ±27 kHz f_{mod} = 1 kHz Tested with U2860B Black screen: channel 1/2 Color bar: channel 1/2			 60/58 58/56		 dB dB
Ripple rejection	Tested from pin 14 to 12(1)	RR	35			dB
Allowable AC output peak current		I_{AC}			±0.7	mA
Allowable DC output current		I_{DC}			–2	mA
AF Output - AM (Pin 6)						
DC output voltage		V_{DC}		2.2		V
Output resistance	(1)	R_{out}			150	Ω
AF output signal	m = 54%(5)	v_{oAF}		500		mV_{rms}
AF bandwidth	–3 dB(5)	B		TBD		kHz
Total harmonic distortion	m = 54% f_{mod} = 1 kHz, 12.5 kHz	THD		1	2	%
Weighted signal-to-noise ratio (CCIR 468)	Reference: m = 54%(5) f_{mod} = 1 kHz	S/N		56		dB
Ripple rejection	Tested from pin 14 to 6(1)	RR	28			dB
Allowable AC output peak current		I_{AC}			±0.3	mA
Allowable DC output current		I_{DC}			–1	mA

Notes:
1. This parameter is given as an application information and is not tested during production.
2. The oscillator drift is related to the picture carrier frequency, with an external temperature-compensated LC circuit.
3. Without external control voltage (pin 7 open), the IC automatically operates in mode 1.
4. Picture carrier PC = 38.9 MHz; sound carrier SC_1 = 33.4 MHz, SC_2 = 33.16 MHz; PC/SC_1 =13 dB; PC/SC_2 = 20 dB; PC unmodulated (equivalent to sync peak level).
5. Sound carrier SC = 32.4 MHz, modulated with f_{mod} = 1 kHz, m = 54%; v_{in} = 10 mV.

Figure 6-1. Test Circuit



7. Internal Pin Configuration

Figure 7-1. Sound IF Inputs (Pins 1 and 2)

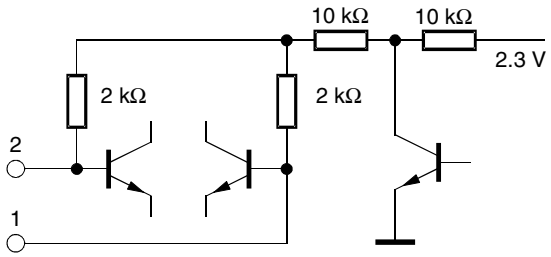


Figure 7-2. AGC Time Constant (Pin 3)

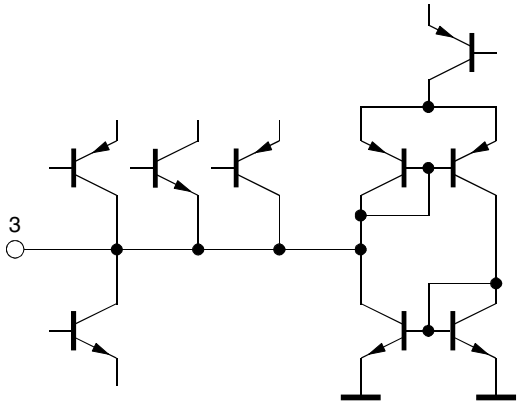


Figure 7-3. Internal Reference Voltage (Pin 4)

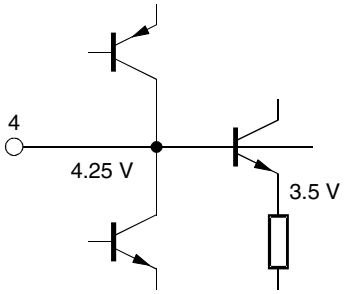


Figure 7-4. Loop Filter (Pin 5)

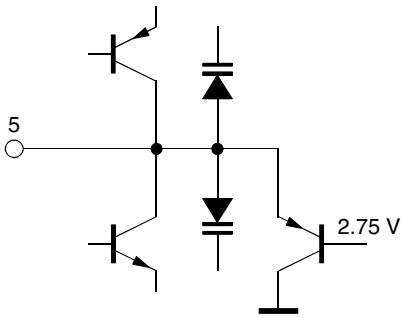


Figure 7-5. AM Output (Pin 6)

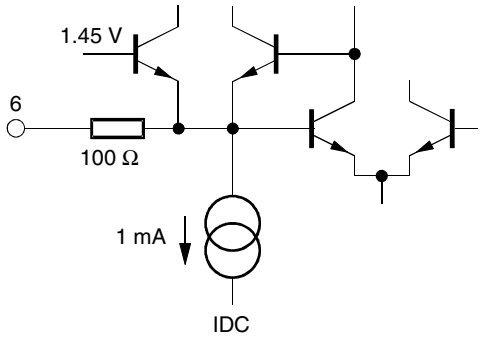


Figure 7-6. AGC Switch (Pin 7)

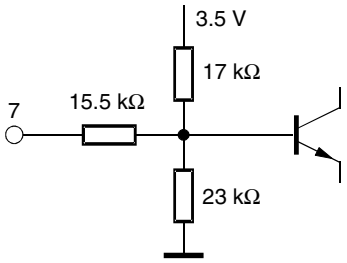


Figure 7-7. VCO (Pins 8 and 9)

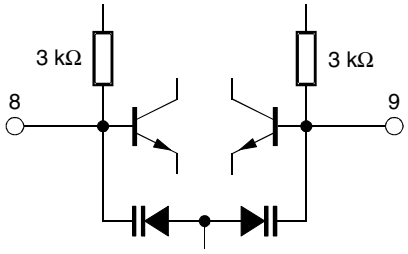


Figure 7-8. Mute Switch (Pin 10)

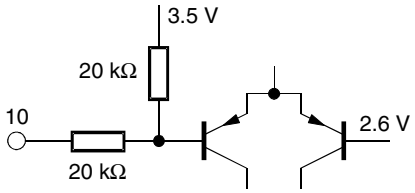
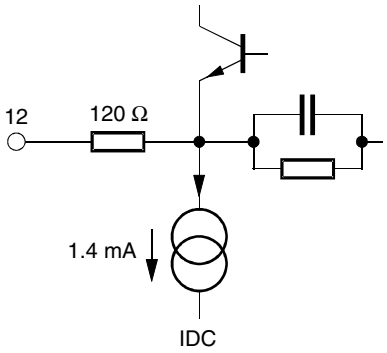


Figure 7-9. Intercarrier Output (Pin 12)



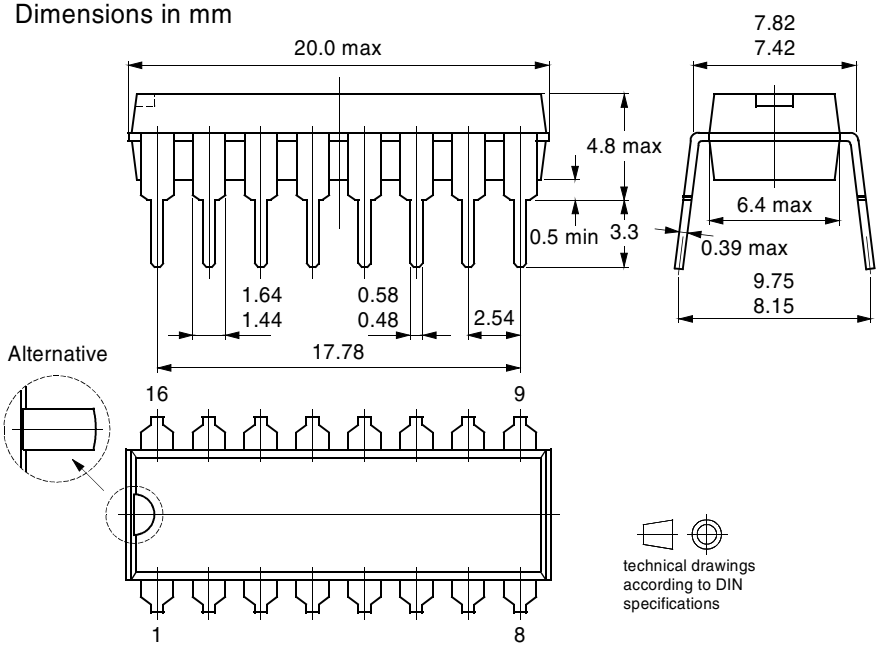
8. Ordering Information

Extended Type Number	Package	Remarks	Standard Package Quantity
U4468B-MG	DIP16, Pb-free	Tube	1,400

9. Package Information

Package DIP16

Dimensions in mm



Atmel Corporation

2325 Orchard Parkway
San Jose, CA 95131, USA
Tel: 1(408) 441-0311
Fax: 1(408) 487-2600

Regional Headquarters

Europe
Atmel Sarl
Route des Arsenaux 41
Case Postale 80
CH-1705 Fribourg
Switzerland
Tel: (41) 26-426-5555
Fax: (41) 26-426-5500

Asia
Room 1219
Chinachem Golden Plaza
77 Mody Road Tsimshatsui
East Kowloon
Hong Kong
Tel: (852) 2721-9778
Fax: (852) 2722-1369

Japan
9F, Tonetsu Shinkawa Bldg.
1-24-8 Shinkawa
Chuo-ku, Tokyo 104-0033
Japan
Tel: (81) 3-3523-3551
Fax: (81) 3-3523-7581

Atmel Operations

Memory
2325 Orchard Parkway
San Jose, CA 95131, USA
Tel: 1(408) 441-0311
Fax: 1(408) 436-4314

Microcontrollers
2325 Orchard Parkway
San Jose, CA 95131, USA
Tel: 1(408) 441-0311
Fax: 1(408) 436-4314

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Fax: 1(719) 540-1759

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Maxwell Building
East Kilbride G75 0QR, Scotland
Tel: (44) 1355-803-000
Fax: (44) 1355-242-743

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Postfach 3535
74025 Heilbronn, Germany
Tel: (49) 71-31-67-0
Fax: (49) 71-31-67-2340

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