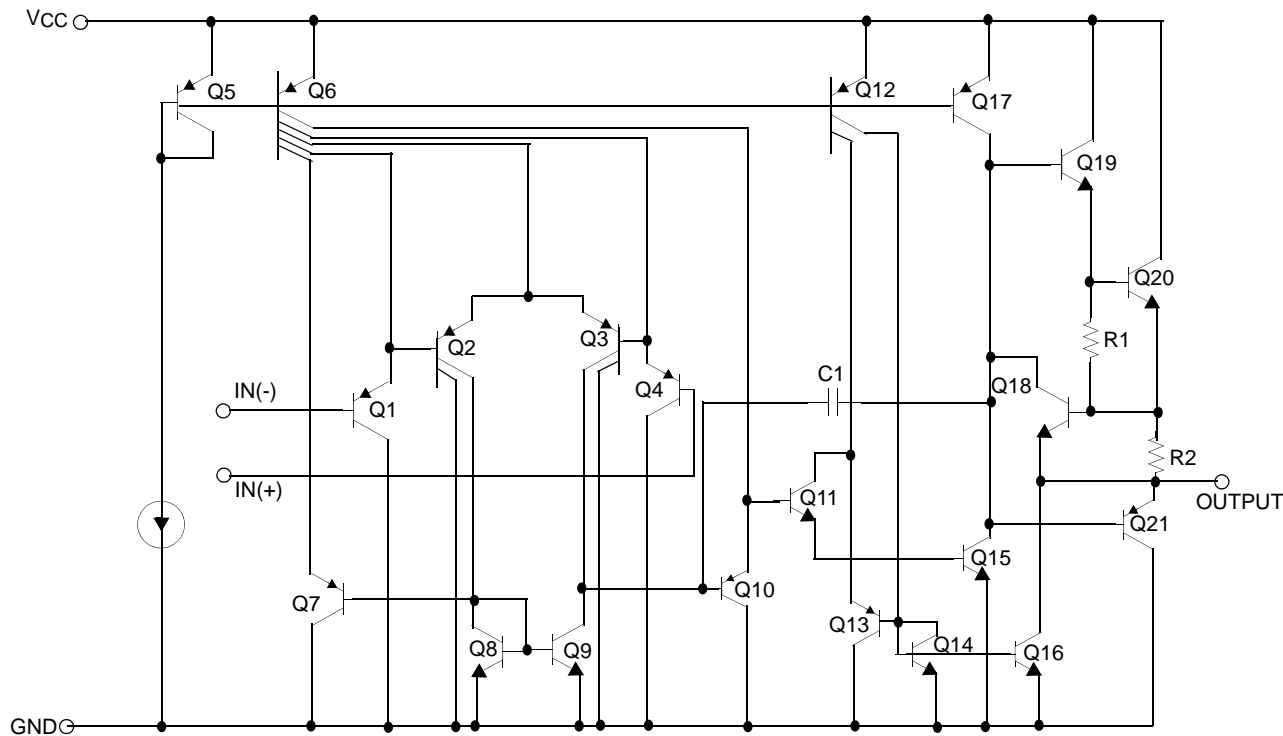


# Schematic Diagram

(One section only)



## Absolute Maximum Ratings

Parameter	Symbol	KA258/KA258A	KA358/KA358A	KA2904	Unit
Supply Voltage	VCC	±16 or 32	±16 or 32	±13 or 26	V
Differential Input Voltage	VI(DIFF)	32	32	26	V
Input Voltage	VI	-0.3 to +32	-0.3 to +32	-0.3 to +26	V
Output Short Circuit to GND VCC≤15V, TA = 25°C(One Amp)	-	Continuous	Continuous	Continuous	-
Operating Temperature Range	TOPR	-25 ~ +85	0 ~ +70	-40 ~ +85	°C
Maximum Junction Temperature	TJ(MAX)	+150	+150	+150	°C
Storage Temperature Range	TSTG	-65 ~ +150	-65 ~ +150	-65 ~ +150	°C

## Electrical Characteristics

( $V_{CC} = 5.0V$ ,  $V_{EE} = GND$ ,  $T_A = 25^\circ C$ , unless otherwise specified)

Parameter	Symbol	Conditions	KA258			KA358			KA2904			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Input Offset Voltage	$V_{IO}$	$V_{CM} = 0V$ to $V_{CC} - 1.5V$ $V_{O(P)} = 1.4V$ , $R_S = 0\Omega$	-	2.9	5.0	-	2.9	7.0	-	2.9	7.0	mV
Input Offset Current	$I_{IO}$	-	-	3	30	-	5	50	-	5	50	nA
Input Bias Current	$I_{BIAS}$	-	-	45	150	-	45	250	-	45	250	nA
Input Voltage Range	$V_{I(R)}$	$V_{CC} = 30V$ (KA2904, $V_{CC} = 26V$ )	0	-	$V_{CC} - 1.5$	0	-	$V_{CC} - 1.5$	0	-	$V_{CC} - 1.5$	V
Supply Current	$I_{CC}$	$R_L = \infty$ , $V_{CC} = 30V$ (KA2904, $V_{CC} = 26V$ )	-	0.8	2.0	-	0.8	2.0	-	0.8	2.0	mA
		$R_L = \infty$ , $V_{CC} = 5V$	-	0.5	1.2	-	0.5	1.2	-	0.5	1.2	mA
Large Signal Voltage Gain	$G_V$	$V_{CC} = 15V$ , $R_L = 2k\Omega$ $V_{O(P)} = 1V$ to $11V$	50	100	-	25	100	-	25	100	-	V/mV
Output Voltage Swing	$V_{O(H)}$	$V_{CC} = 30V$ , $R_L = 2k\Omega$	26	-	-	26	-	-	22	-	-	V
		$V_{CC} = 26V$ for KA2904)	27	28	-	27	28	-	23	24	-	V
	$V_{O(L)}$	$V_{CC} = 5V$ , $R_L = 10k\Omega$	-	5	20	-	5	20	-	5	20	mV
Common-Mode Rejection Ratio	CMRR	-	70	85	-	65	80	-	50	80	-	dB
Power Supply Rejection Ratio	PSRR	-	65	100	-	65	100	-	50	100	-	dB
Channel Separation	CS	$f = 1kHz$ to $20kHz$ (Note1)	-	120	-	-	120	-	-	120	-	dB
Short Circuit to GND	ISC	-	-	40	60	-	40	60	-	40	60	mA
Output Current	ISOURCE	$V_{I(+)} = 1V$ , $V_{I(-)} = 0V$ $V_{CC} = 15V$ , $V_{O(P)} = 2V$	20	30	-	20	30	-	20	30	-	mA
	ISINK	$V_{I(+)} = 0V$ , $V_{I(-)} = 1V$ $V_{CC} = 15V$ , $V_{O(P)} = 2V$	10	15	-	10	15	-	10	15	-	mA
		$V_{I(+)} = 0V$ , $V_{I(-)} = 1V$ $V_{CC} = 15V$ , $V_{O(P)} = 200mV$	12	100	-	12	100	-	-	-	-	$\mu A$
Differential Input Voltage	$V_{I(DIFF)}$	-	-	-	$V_{CC}$	-	-	$V_{CC}$	-	-	$V_{CC}$	V

### Note:

1. This parameter, although guaranteed, is not 100% tested in production.

**Electrical Characteristics** (Continued)(V<sub>CC</sub> = 5.0V, V<sub>EE</sub> = GND, unless otherwise specified)The following specification apply over the range of -25°C ≤ T<sub>A</sub> ≤ +85°C for the KA258; and the 0 °C ≤ T<sub>A</sub> ≤ +70°C for the KA358; and the -40°C ≤ T<sub>A</sub> ≤ +85°C for the KA2904

Parameter	Symbol	Conditions		KA258			KA358			KA2904			Unit
				Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Input Offset Voltage	V <sub>IO</sub>	V <sub>CM</sub> = 0V to V <sub>CC</sub> -1.5V V <sub>O</sub> (P) = 1.4V, R <sub>S</sub> = 0Ω		-	-	7.0	-	-	9.0	-	-	10.0	mV
Input Offset Voltage Drift	ΔV <sub>IO</sub> /ΔT	R <sub>S</sub> = 0Ω		-	7.0	-	-	7.0	-	-	7.0	-	μV/°C
Input Offset Current	I <sub>IO</sub>	-		-	-	100	-	-	150	-	45	200	nA
Input Offset Current Drift	ΔI <sub>IO</sub> /ΔT	-		-	10	-	-	10	-	-	10	-	pA/°C
Input Bias Current	I <sub>BIAS</sub>	-		-	40	300	-	40	500	-	40	500	nA
Input Voltage Range	V <sub>I</sub> (R)	V <sub>CC</sub> = 30V (KA2904, V <sub>CC</sub> = 26V)		0	-	V <sub>CC</sub> -2.0	0	-	V <sub>CC</sub> -2.0	0	-	V <sub>CC</sub> -2.0	V
Large Signal Voltage Gain	G <sub>V</sub>	V <sub>CC</sub> = 15V, R <sub>L</sub> =2.0kΩ V <sub>O</sub> (P) = 1V to 11V		25	-	-	15	-	-	15	-	-	V/mV
Output Voltage Swing	V <sub>O</sub> (H)	V <sub>CC</sub> = 30V	R <sub>L</sub> = 2kΩ	26	-	-	26	-	-	22	-	-	V
		(V <sub>CC</sub> = 26V for KA2904)	R <sub>L</sub> = 10kΩ	27	28	-	27	28	-	23	24	-	V
	V <sub>O</sub> (L)	V <sub>CC</sub> = 5V, R <sub>L</sub> =10kΩ		-	5	20	-	5	20	-	5	20	mV
Output Current	I <sub>SOURCE</sub>	V <sub>I</sub> (+) = 1V, V <sub>I</sub> (-) = 0V V <sub>CC</sub> = 15V, V <sub>O</sub> (P) = 2V		10	30	-	10	30	-	10	30	-	mA
	I <sub>SINK</sub>	V <sub>I</sub> (+) = 0V, V <sub>I</sub> (-) = 1V V <sub>CC</sub> = 15V, V <sub>O</sub> (P) = 2V		5	8	-	5	9	-	5	9	-	mA
Differential Input Voltage	V <sub>I</sub> (DIFF)	-		-	-	V <sub>CC</sub>	-	-	V <sub>CC</sub>	-	-	V <sub>CC</sub>	V

**Electrical Characteristics** (Continued)(V<sub>CC</sub> = 5.0V, V<sub>EE</sub> = GND, T<sub>A</sub> = 25°C, unless otherwise specified)

Parameter	Symbol	Conditions	KA258A			KA358A			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Input Offset Voltage	V <sub>IO</sub>	V <sub>CM</sub> = 0V to V <sub>CC</sub> -1.5V V <sub>O(P)</sub> = 1.4V, R <sub>S</sub> = 0Ω	-	1.0	3.0	-	2.0	3.0	mV
Input Offset Current	I <sub>IO</sub>	-	-	2	15	-	5	30	nA
Input Bias Current	I <sub>BIAS</sub>	-	-	40	80	-	45	100	nA
Input Voltage Range	V <sub>I(R)</sub>	V <sub>CC</sub> = 30V	0	-	V <sub>CC</sub> -1.5	0	-	V <sub>CC</sub> -1.5	V
Supply Current	I <sub>CC</sub>	R <sub>L</sub> = ∞, V <sub>CC</sub> = 30V	-	0.8	2.0	-	0.8	2.0	mA
		R <sub>L</sub> = ∞, V <sub>CC</sub> = 5V	-	0.5	1.2	-	0.5	1.2	mA
Large Signal Voltage Gain	G <sub>V</sub>	V <sub>CC</sub> = 15V, R <sub>L</sub> = 2kΩ V <sub>O</sub> = 1V to 11V	50	100	-	25	100	-	V/mV
Output Voltage Swing	V <sub>OH</sub>	V <sub>CC</sub> = 30V	26	-	-	26	-	-	V
	V <sub>OL</sub>	V <sub>CC</sub> = 5V, R <sub>L</sub> = 10kΩ	-	5	20	-	5	20	mV
Common-Mode Rejection Ratio	CMRR	-	70	85	-	65	85	-	dB
Power Supply Rejection Ratio	PSRR	-	65	100	-	65	100	-	dB
Channel Separation	CS	f = 1kHz to 20kHz (Note1)	-	120	-	-	120	-	dB
Short Circuit to GND	I <sub>SC</sub>	-	-	40	60	-	40	60	mA
Output Current	I <sub>SOURCE</sub>	V <sub>I(+)</sub> = 1V, V <sub>I(-)</sub> = 0V V <sub>CC</sub> = 15V, V <sub>O(P)</sub> = 2V	20	30	-	20	30	-	mA
	I <sub>SINK</sub>	V <sub>I(+)</sub> = 1V, V <sub>I(-)</sub> = 0V V <sub>CC</sub> = 15V, V <sub>O(P)</sub> = 2V	10	15	-	10	15	-	mA
		V <sub>in(+)</sub> = 0V, V <sub>in(-)</sub> = 1V V <sub>O(P)</sub> = 200mV	12	100	-	12	100	-	μA
Differential Input Voltage	V <sub>I(DIFF)</sub>	-	-	-	V <sub>CC</sub>	-	-	V <sub>CC</sub>	V

**Note:**

1. This parameter, although guaranteed, is not 100% tested in production.

**Electrical Characteristics** (Continued)(V<sub>CC</sub> = 5.0V, V<sub>EE</sub> = GND, unless otherwise specified)The following specification apply over the range of -25°C ≤ T<sub>A</sub> ≤ +85°C for the KA258A; and the 0°C ≤ T<sub>A</sub> ≤ +70°C for the KA358A

Parameter	Symbol	Conditions	KA258A			KA358A			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Input Offset Voltage	V <sub>IO</sub>	V <sub>CM</sub> = 0V to V <sub>CC</sub> -1.5V V <sub>O(P)</sub> = 1.4V, R <sub>S</sub> = 0Ω	-	-	4.0	-	-	5.0	mV
Input Offset Voltage Drift	ΔV <sub>IO</sub> /ΔT	-	-	7.0	15	-	7.0	20	μV/°C
Input Offset Current	I <sub>IO</sub>	-	-	-	30	-	-	75	nA
Input Offset Current Drift	ΔI <sub>IO</sub> /ΔT	-	-	10	200	-	10	300	pA/°C
Input Bias Current	I <sub>BIAS</sub>	-	-	40	100	-	40	200	nA
Input Common-Mode Voltage Range	V <sub>I(R)</sub>	V <sub>CC</sub> = 30V	0	-	V <sub>CC</sub> -2.0	0	-	V <sub>CC</sub> -2.0	V
Output Voltage Swing	V <sub>O(H)</sub>	V <sub>CC</sub> = 30V	R <sub>L</sub> = 2kΩ		26	-	-	26	V
			R <sub>L</sub> = 10kΩ		27	28	-	27	V
	V <sub>O(L)</sub>	V <sub>CC</sub> = 5V, R <sub>L</sub> = 10kΩ	-	5	20	-	5	20	mV
Large Signal Voltage Gain	G <sub>V</sub>	V <sub>CC</sub> = 15V, R <sub>L</sub> = 2.0kΩ V <sub>O(P)</sub> = 1V to 11V	25	-	-	15	-	-	V/mV
Output Current	I <sub>SOURCE</sub>	V <sub>I(+)</sub> = 1V, V <sub>I(-)</sub> = 0V V <sub>CC</sub> = 15V, V <sub>O(P)</sub> = 2V	10	30	-	10	30	-	mA
	I <sub>SINK</sub>	V <sub>I(+)</sub> = 1V, V <sub>I(-)</sub> = 0V V <sub>CC</sub> = 15V, V <sub>O(P)</sub> = 2V	5	9	-	5	9	-	mA
Differential Input Voltage	V <sub>I(DIFF)</sub>	-	-	-	V <sub>CC</sub>	-	-	V <sub>CC</sub>	V

## Typical Performance Characteristics

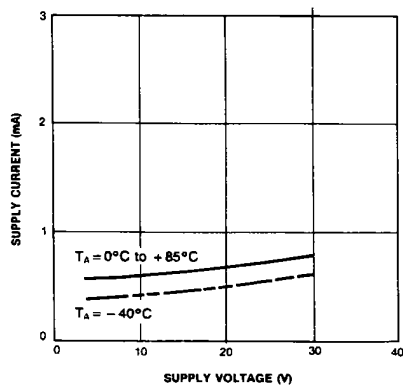


Figure 1. Supply Current vs Supply Voltage

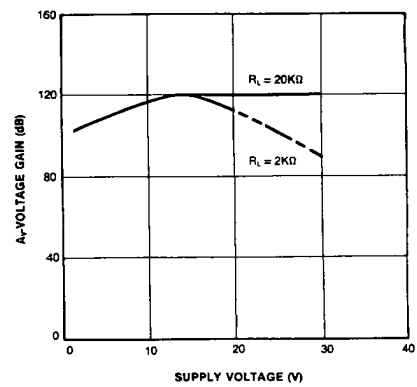


Figure 2. Voltage Gain vs Supply Voltage

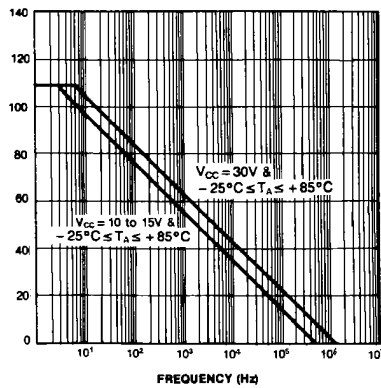


Figure 3. Open Loop Frequency Response

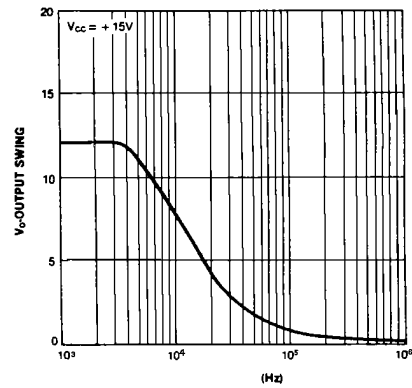


Figure 4. Large Signal Output Swing vs Frequency

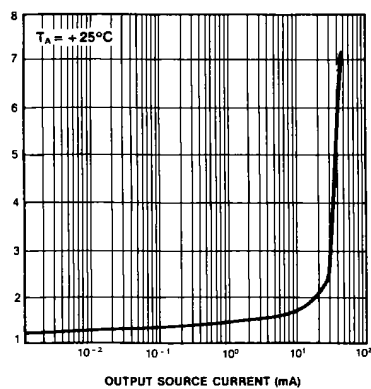


Figure 5. Output Characteristics vs Current Sourcing

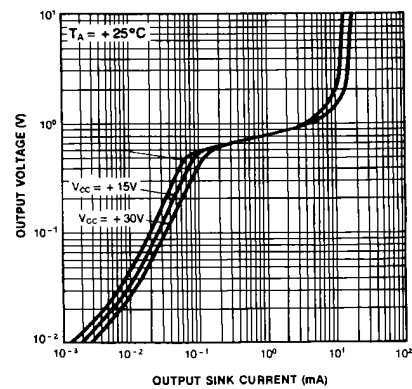


Figure 6. Output Characteristics vs Current Sinking

## Typical Performance Characteristics (Continued)

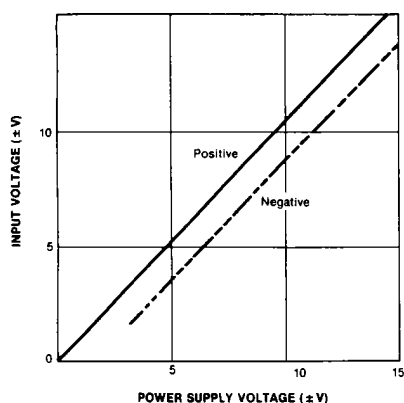


Figure 7. Input Voltage Range vs Supply Voltage

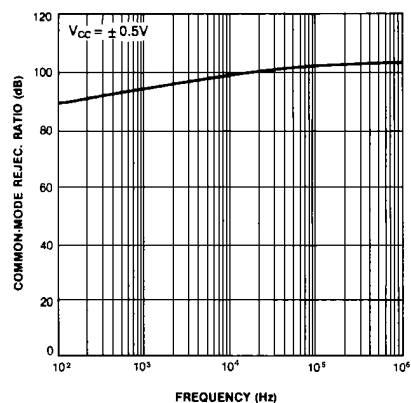


Figure 8. Common-Mode Rejection Ratio

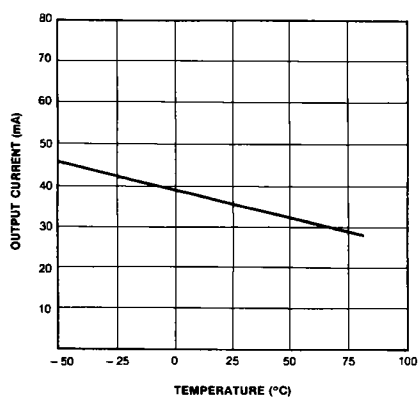


Figure 9. Output Current vs Temperature (Current Limiting)

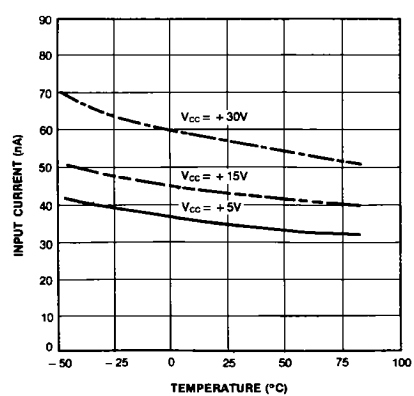


Figure 10. Input Current vs Temperature

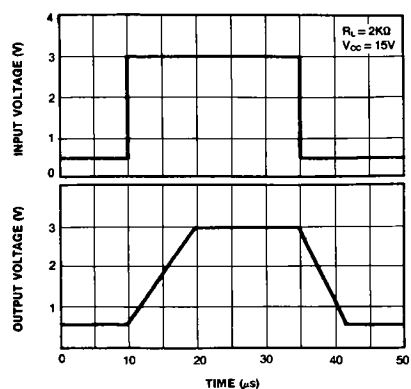


Figure 11. Voltage Follower Pulse Response

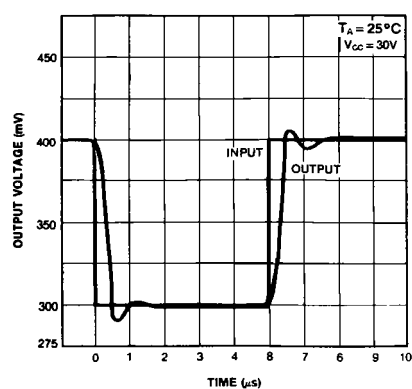


Figure 12. Voltage Follower Pulse Response (Small Signal)



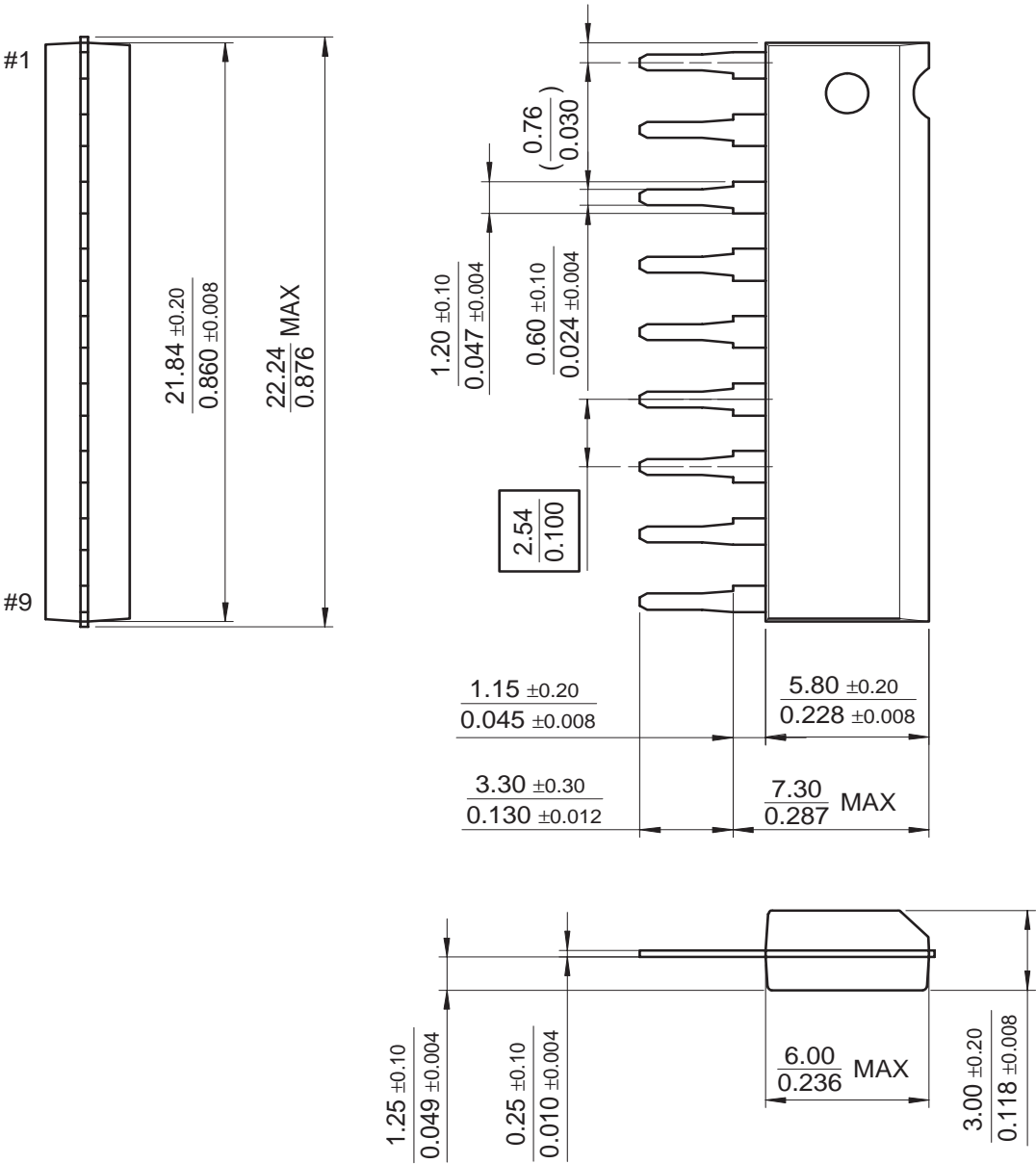


Mechanical Dimensions (Continued)

Package

Dimensions in millimeters

9-SIP



## Ordering Information

Product Number	Package	Operating Temperature
KA358	8-DIP	0 ~ +70°C
KA358A		
KA358D	8-SOP	
KA358AD		
KA358S	9-SIP	
KA358AS		
KA258	8-DIP	-25 ~ +85°C
KA258A		
KA258D	8-SOP	
KA258AD		
KA2904	8-DIP	-40 ~ +85°C
KA2904D	8-SOP	

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.