

Low Noise Precision Rail-to-Rail Output Dual CMOS Operational Amplifier

■ GENERAL DESCRIPTION

The NJU7077 is a high precision Rail-to-Rail output dual CMOS operational amplifier featuring a low noise of $10\text{nV}/\sqrt{\text{Hz}}$ (typ.), low input offset voltage of $150\mu\text{V}$ (max.), low temperature drift of $0.5\mu\text{V}/^\circ\text{C}$ (typ.) and low bias current of 1pA (typ.). The output swing can reach 50 mV from the rails, while driving a $10\text{k}\Omega$ load (at 5V operation). The NJU7077 also has a high RF noise immunity which can reduce malfunctions caused by RF noises from mobile phones and others. The combination of these specifications makes the NJU7077 well-sited for sensor applications such as a temperature sensor, weight sensor and others, high precision current sensing amplifiers and current voltage converters. The NJU7077 is available in a small surface mount package of MSOP8 (VSP8) meeting JEDEC MO-187-DA.

■ PACKAGE OUTLINE



NJU7077R
(MSOP8 (VSP8))

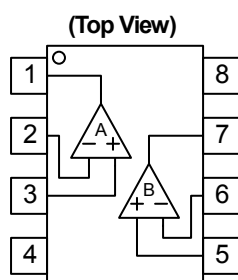
■ FEATURES

- Precision
 - Offset Voltage $150\mu\text{V}$ max.
 - Low Drift $0.5\mu\text{V}/^\circ\text{C}$ typ.
- Noise Voltage $10\text{nV}/\sqrt{\text{Hz}}$ typ.
- Low Bias Current 1pA typ.
- Rail-to-rail Output $+0.05\text{V}$ to $V_{\text{DD}} - 0.05\text{V}$ ($R_{\text{L}} = 10\text{k}\Omega$)
- RF Immunity
- Operating Voltage $+2.2\text{V}$ to $+5.5\text{V}$
- Package MSOP8 (VSP8) MEET JEDEC MO-187-DA

■ APPLICATIONS

- Thermocouple / Thermopile Amplifiers
- Strain Gauge / Pressure sensor Amplifiers
- Load Cell and Bridge Transducer Amplifiers
- High Resolution Data Acquisition
- Precision Current Sensing

■ Pin CONFIGURATION



PIN FUNCTION

- 1: A OUTPUT
- 2: A -INPUT
- 3: A +INPUT
- 4: VSS
- 5: B -INPUT
- 6: B +INPUT
- 7: B OUTPUT
- 8: VDD

■ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted.)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V _{DD}	+7	V
Common Mode Input Voltage Range	V _{ICM}	V _{SS} - 0.3 to V _{DD} + 0.3	V
Differential Input Voltage Range	V _{ID}	±7 (Note1)	V
Power Dissipation(Note3)	P _D	500(Note2)	mW
Operating Temperature Range	T _{opr}	-40 to +125	°C
Storage Temperature Range	T _{stg}	-55 to +150	°C

(Note1) For supply voltage less than 7V, the absolute maximum input voltage is equal to supply voltage.

(Note2) On the PCB "EIA/JEDEC(76.2×114.3×1.6mm, 2 layers, FR-4)"

(Note3) Do not exceed "Power dissipation: PD" in which power dissipation in IC is shown by the absolute maximum rating.

Refer to following Figure 1 for a permissible loss when ambient temperature (Ta) is Ta≥25°C.

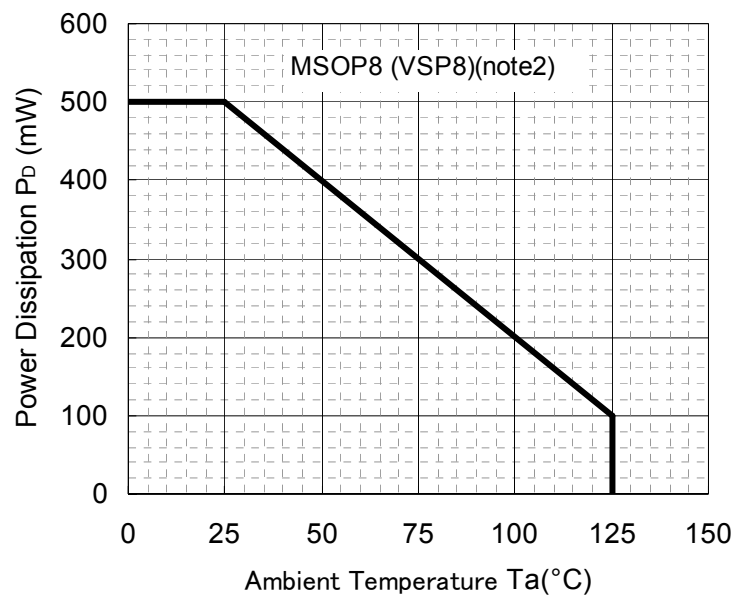


Figure1: PD – Temperature

■RECOMMENDED OPERATING CONDITIONS (Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V _{DD}		+2.2	-	+5.5	V

■ELECTRICAL CHARACTERISTICS

●DC CHARACTERISTICS ($V_{DD}=5V$, $V_{SS}=0V$, $V_{ICM}=2.5V$, $T_a=25^{\circ}C$, unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current	I_{CC}	No Signal	-	1.2	1.8	mA
		No Signal, $T_a=-40^{\circ}C$ to $125^{\circ}C$	-	-	1.8	
Input Offset Voltage	V_{IO}		-	20	150	μV
		$T_a=-40^{\circ}C$ to $125^{\circ}C$	-	-	400	
Input Offset Voltage Drift	TCV_{IO}	$T_a=-40^{\circ}C$ to $125^{\circ}C$ (Note4)	-	0.5	5.0	$\mu V/^{\circ}C$
Input Bias Current	I_B		-	1	-	pA
Input Offset Current	I_{IO}		-	1	-	pA
Voltage Gain	A_v	$V_{out}=0.5V$ to $4.5V$, $R_L=10k\Omega$ to $2.5V$	100	130	-	dB
		$V_{out}=0.5V$ to $4.5V$, $R_L=10k\Omega$ to $2.5V$, $T_a=-40^{\circ}C$ to $125^{\circ}C$	100	-	-	
Common Mode Rejection Ratio	CMR	$V_{ICM}=0V$ to $4V$	70	90	-	dB
		$V_{ICM}=0V$ to $4V$, $T_a=-40^{\circ}C$ to $125^{\circ}C$	70	-	-	
Supply Voltage Rejection Ratio	SVR	$V_{DD}=2.2V$ to $5.5V$	70	90	-	dB
		$V_{DD}=2.2V$ to $5.5V$, $T_a=-40^{\circ}C$ to $125^{\circ}C$	70	-	-	
Maximum Output Voltage	V_{OH}	$R_L=10k\Omega$ to $2.5V$	4.95	4.98	-	V
		$R_L=10k\Omega$ to $2.5V$, $T_a=-40^{\circ}C$ to $125^{\circ}C$	4.95	-	-	
		$R_L=600\Omega$ to $2.5V$	4.85	4.92	-	
		$R_L=600\Omega$ to $2.5V$, $T_a=-40^{\circ}C$ to $125^{\circ}C$	4.85	-	-	
		$I_O=2mA$	4.9	4.96	-	
		$I_O=2mA$, $T_a=-40^{\circ}C$ to $125^{\circ}C$	4.85	-	-	
	V_{OL}	$R_L=10k\Omega$ to $2.5V$	-	0.02	0.05	V
		$R_L=10k\Omega$ to $2.5V$, $T_a=-40^{\circ}C$ to $125^{\circ}C$	-	-	0.05	
		$R_L=600\Omega$ to $2.5V$	-	0.08	0.15	
		$R_L=600\Omega$ to $2.5V$, $T_a=-40^{\circ}C$ to $125^{\circ}C$	-	-	0.2	
		$I_O=2mA$	-	0.04	0.1	
		$I_O=2mA$, $T_a=-40^{\circ}C$ to $125^{\circ}C$	-	-	0.15	
Common Mode Input Voltage Range	V_{ICM}	CMR $\geq 70dB$	0	-	4	V
		CMR $\geq 70dB$, $T_a=-40^{\circ}C$ to $125^{\circ}C$	0	-	4	

(Note4) Guaranteed by two points of Temperature $-40^{\circ}C$ and $+125^{\circ}C$

●AC CHARACTERISTICS ($V_{DD}=5V$, $V_{SS}=0V$, $V_{ICM}=2.5V$, $T_a=25^{\circ}C$, unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gain Bandwidth Product	GBW	$G_V=40dB$, $R_F=100k\Omega$, $R_L=10k\Omega$, $C_L=20pF$	-	1.3	-	MHz
Phase Margin	ϕ_M	$G_V=40dB$, $R_F=100k\Omega$, $R_L=10k\Omega$, $C_L=20pF$	-	60	-	deg
Gain Margin	G_M	$G_V=40dB$, $R_F=100k\Omega$, $R_L=10k\Omega$, $C_L=20pF$	-	12	-	dB
Equivalent Input Noise Voltage	V_{NI}	$f=1kHz$	-	10	-	$nV/\sqrt{Hz}$
Slew Rate	SR	$G_V=0dB$, $R_L=10k\Omega$, $C_L=20pF$, $V_{IN}=4V_{PP}$	-	0.5	-	V/ μs
Total Harmonic Distortion	THD	$G_V=20dB$, $R_L=10k\Omega$, $f=1kHz$, $V_O=3V_{PP}$	-	0.01	-	%
Channel Separation	CS	$f=1kHz$	-	140	-	dB

●DC CHARACTERISTICS ($V_{DD}=2.2V$, $V_{SS}=0V$, $V_{ICM}=1.1V$, $T_a=25^\circ C$, unless otherwise noted.)

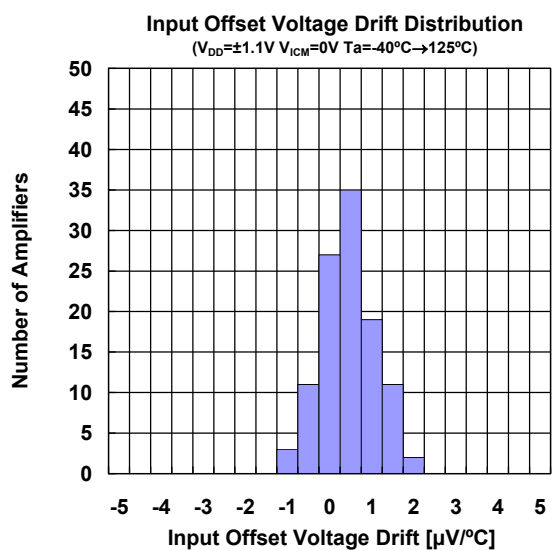
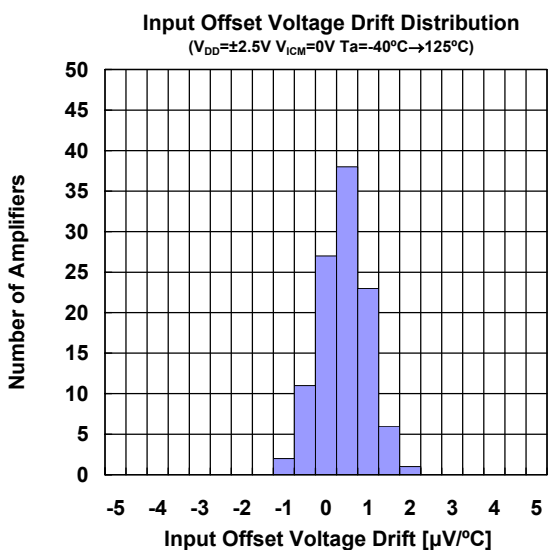
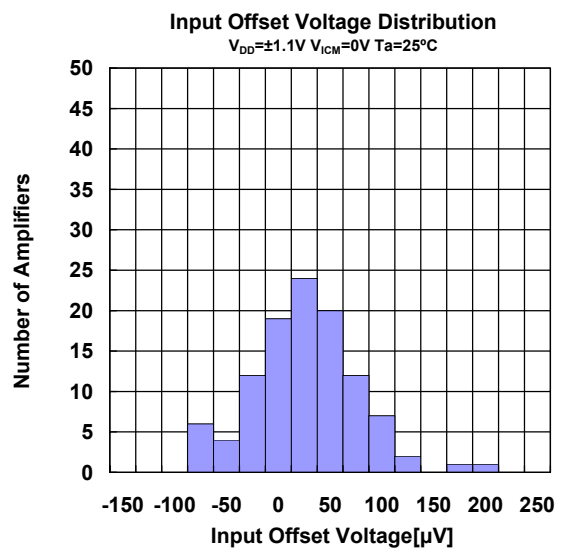
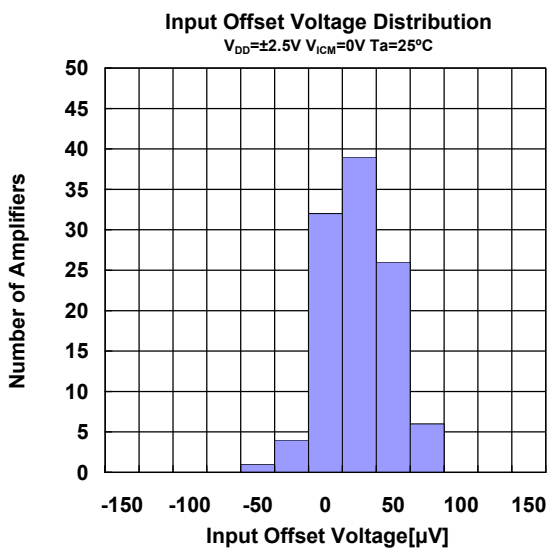
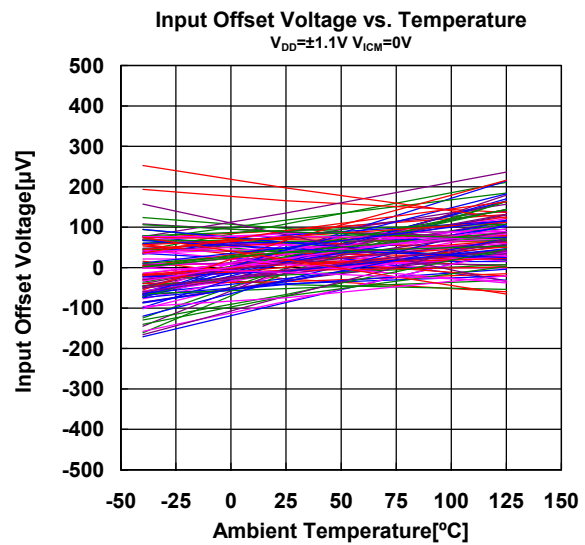
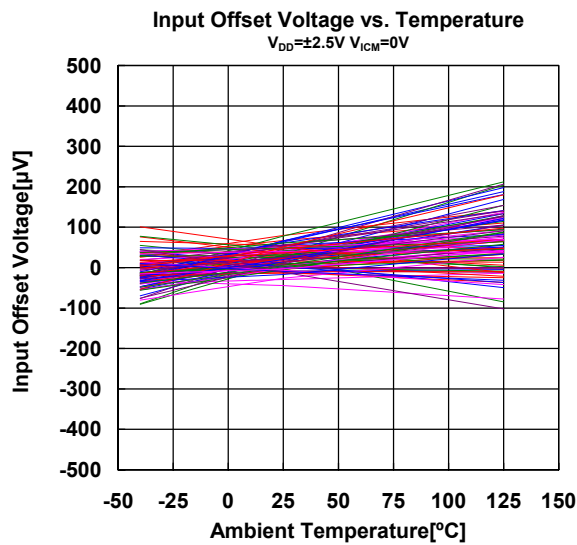
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current	I_{CC}	No Signal	-	1.0	1.5	mA
		No Signal, $T_a=-40^\circ C$ to $125^\circ C$	-	-	1.5	
Input Offset Voltage	V_{IO}		-	60	250	μV
		$T_a=-40^\circ C$ to $125^\circ C$	-	-	400	
Input Offset Voltage Drift	TCV_{IO}	$T_a=-40^\circ C$ to $125^\circ C$ (Note4)	-	0.6	5.0	$\mu V/^\circ C$
Input Bias Current	I_B		-	1	-	pA
Input Offset Current	I_{IO}		-	1	-	pA
Voltage Gain	A_v	$V_{out}=0.6V$ to $1.6V$, $R_L=10k\Omega$ to $1.1V$	100	130	-	dB
		$V_{out}=0.6V$ to $1.6V$, $R_L=10k\Omega$ to $1.1V$, $T_a=-40^\circ C$ to $125^\circ C$	100	-	-	
Common Mode Rejection Ratio	CMR	$V_{ICM}=0V$ to $1.2V$	70	90	-	dB
		$V_{ICM}=0V$ to $1.2V$, $T_a=-40^\circ C$ to $125^\circ C$	70	-	-	
Maximum Output Voltage	V_{OH}	$R_L=10k\Omega$ to $1.1V$	2.15	2.18	-	V
		$R_L=10k\Omega$ to $1.1V$, $T_a=-40^\circ C$ to $125^\circ C$	2.15	-	-	
		$R_L=600\Omega$ to $1.1V$	2.1	2.14	-	
		$R_L=600\Omega$ to $1.1V$, $T_a=-40^\circ C$ to $125^\circ C$	2.05	-	-	
		$I_O=2mA$	2.05	2.13	-	
		$I_O=2mA$, $T_a=-40^\circ C$ to $125^\circ C$	2.0	-	-	
	V_{OL}	$R_L=10k\Omega$ to $1.1V$	-	0.02	0.05	V
		$R_L=10k\Omega$ to $1.1V$, $T_a=-40^\circ C$ to $125^\circ C$	-	-	0.05	
		$R_L=600\Omega$ to $1.1V$	-	0.06	0.1	
		$R_L=600\Omega$ to $1.1V$, $T_a=-40^\circ C$ to $125^\circ C$	-	-	0.15	
		$I_O=2mA$	-	0.07	0.15	
		$I_O=2mA$, $T_a=-40^\circ C$ to $125^\circ C$	-	-	0.2	
Common Mode Input Voltage Range	V_{ICM}	CMR $\geq 70dB$	0	-	1.2	V
		CMR $\geq 70dB$, $T_a=-40^\circ C$ to $125^\circ C$	0	-	1.2	

(Note4) Guaranteed by two points of Temperature $-40^\circ C$ and $+125^\circ C$

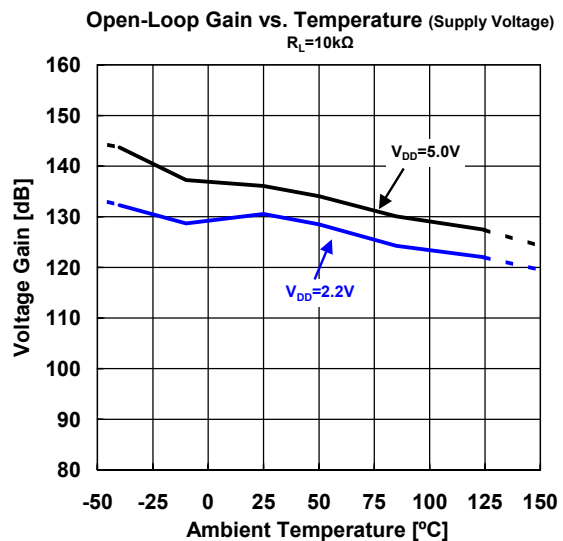
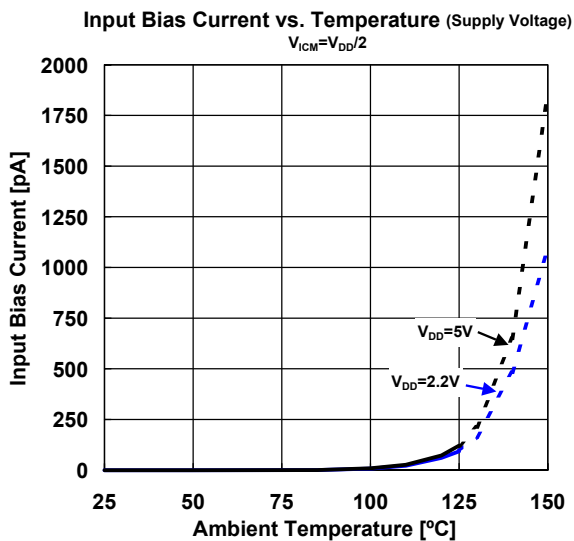
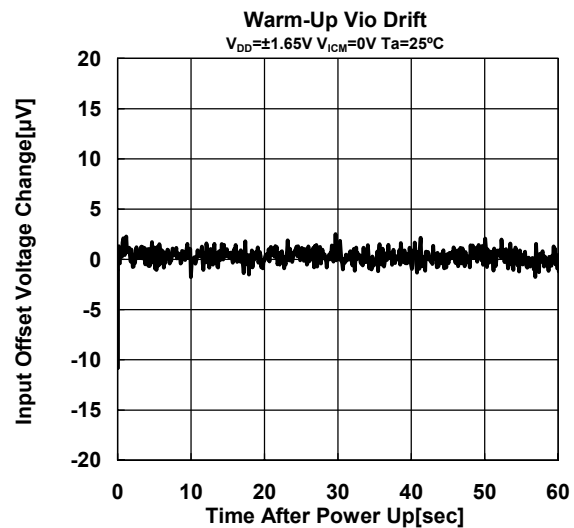
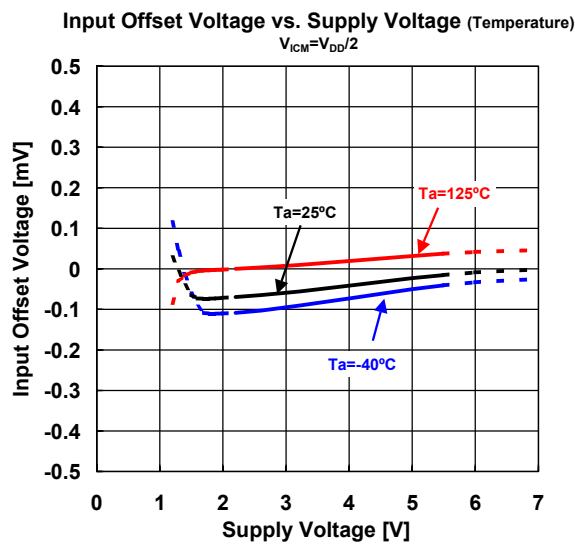
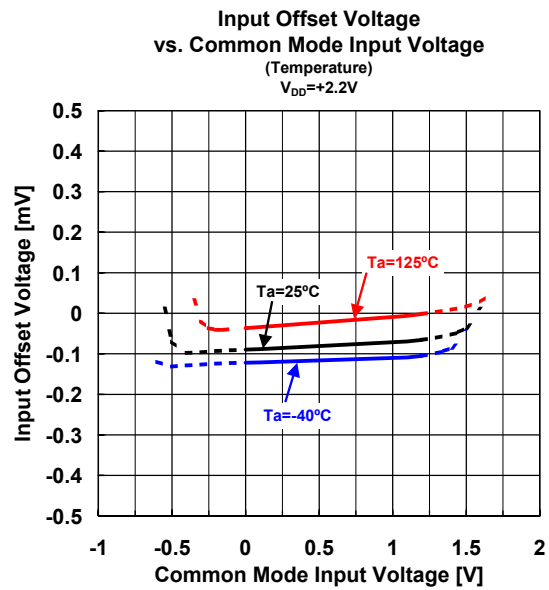
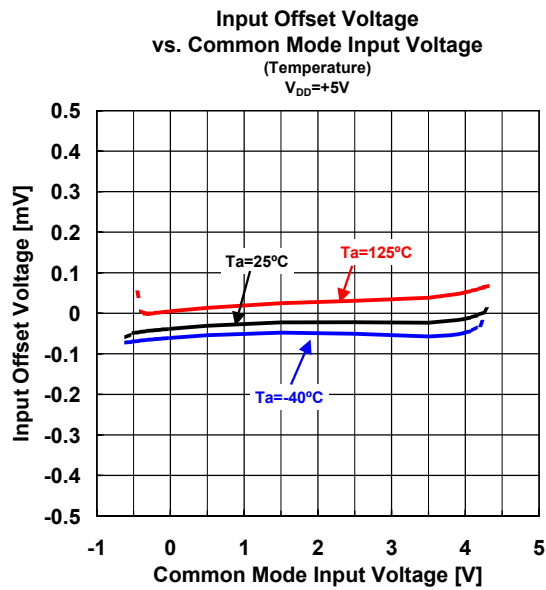
●AC CHARACTERISTICS ($V_{DD}=2.2V$, $V_{SS}=0V$, $V_{ICM}=1.1V$, $T_a=25^\circ C$, unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gain Bandwidth Product	GBW	$G_V=40dB$, $R_F=100k\Omega$, $R_L=10k\Omega$, $C_L=20pF$	-	1.2	-	MHz
Phase Margin	ϕ_M	$G_V=40dB$, $R_F=100k\Omega$, $R_L=10k\Omega$, $C_L=20pF$	-	60	-	deg
Gain Margin	G_M	$G_V=40dB$, $R_F=100k\Omega$, $R_L=10k\Omega$, $C_L=20pF$	-	12	-	dB
Equivalent Input Noise Voltage	V_{NI}	$f=1kHz$	-	10	-	$nV/\sqrt{Hz}$
Slew Rate	SR	$G_V=0dB$, $R_L=10k\Omega$, $C_L=20pF$, $V_{IN}=1V_{PP}$	-	0.5	-	$V/\mu s$
Total Harmonic Distortion	THD	$G_V=20dB$, $R_L=10k\Omega$, $f=1kHz$, $V_O=1V_{PP}$	-	0.01	-	%
Channel Separation	CS	$f=1kHz$	-	140	-	dB

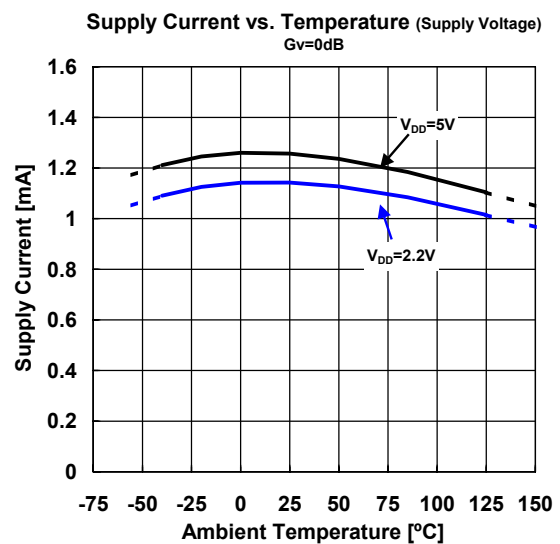
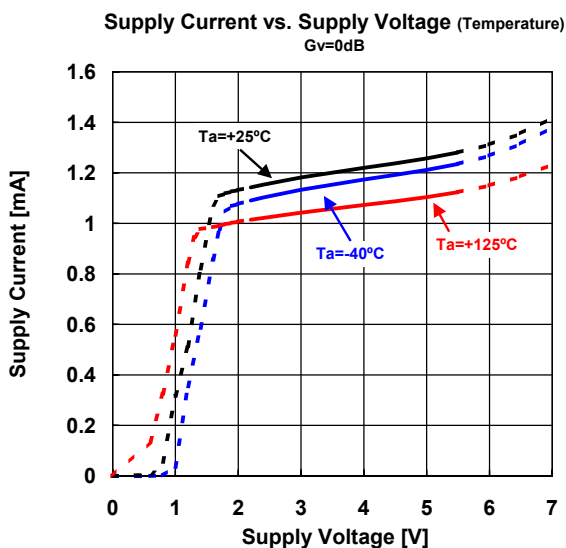
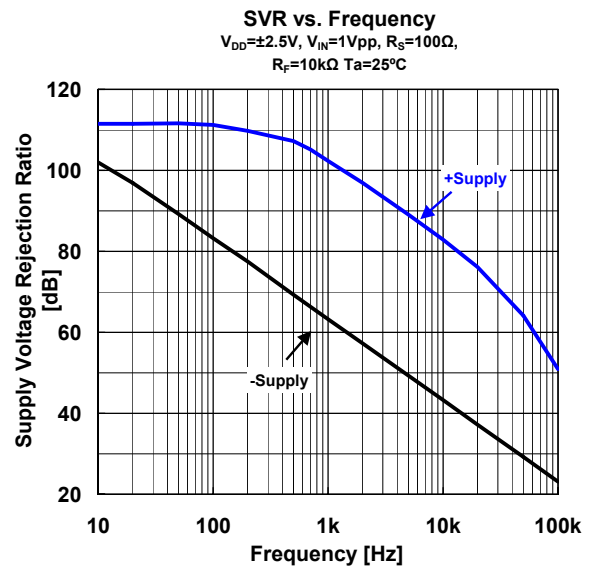
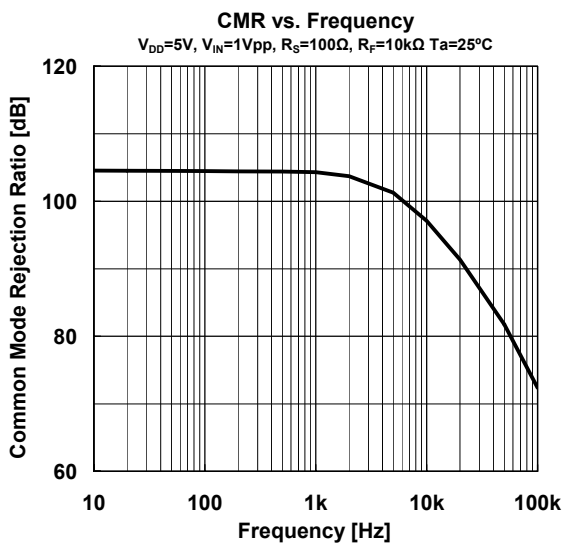
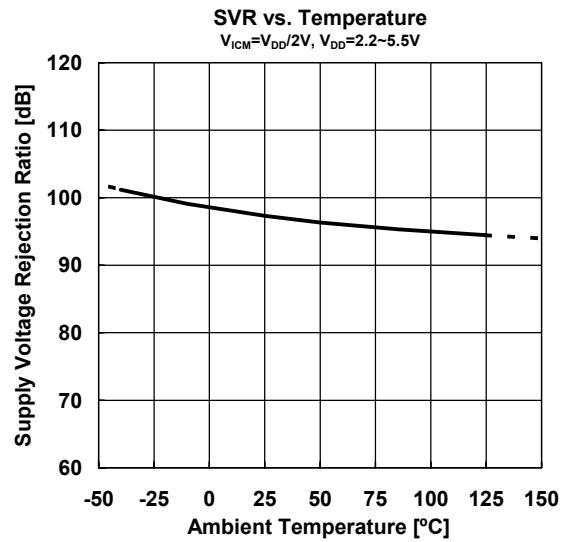
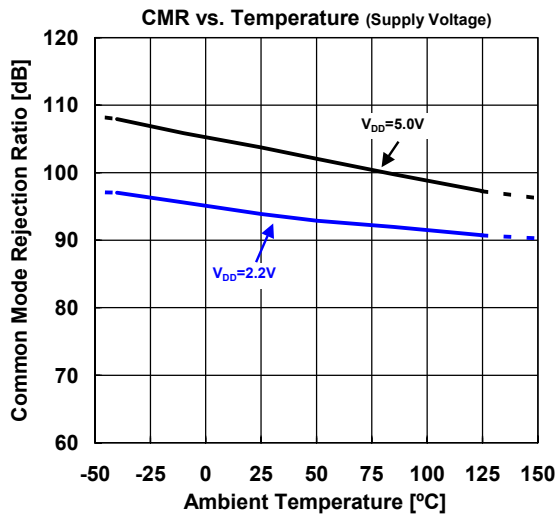
■ TYPICAL CHARACTERISTICS



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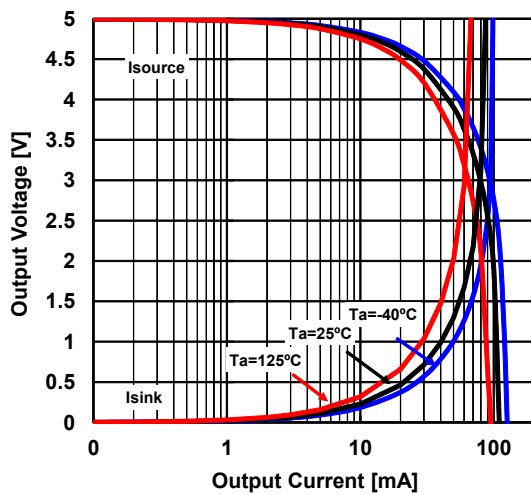


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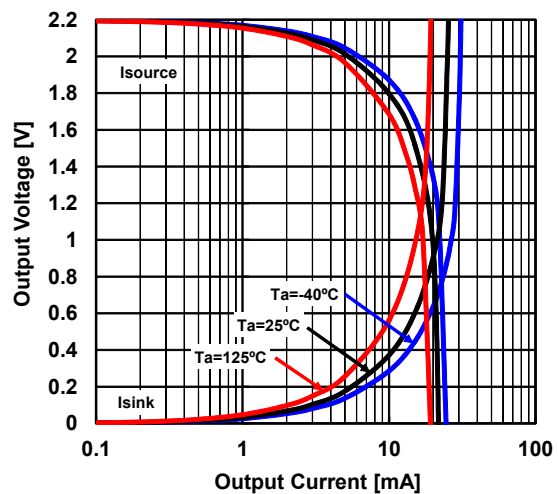


■ TYPICAL CHARACTERISTICS

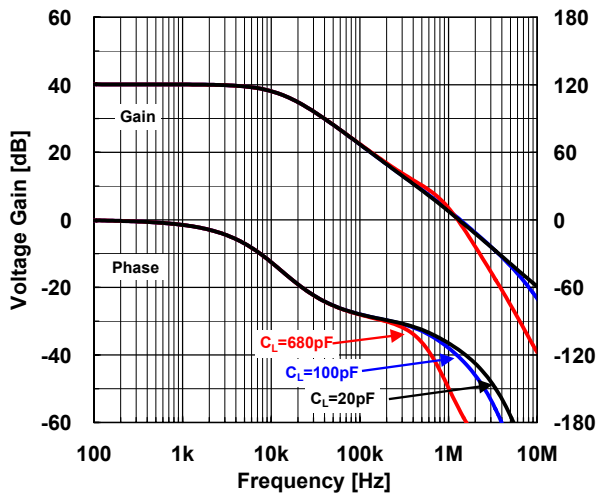
Maximum Output Voltage vs. Output Current
(Temperature)
 $V_{DD}=5V$



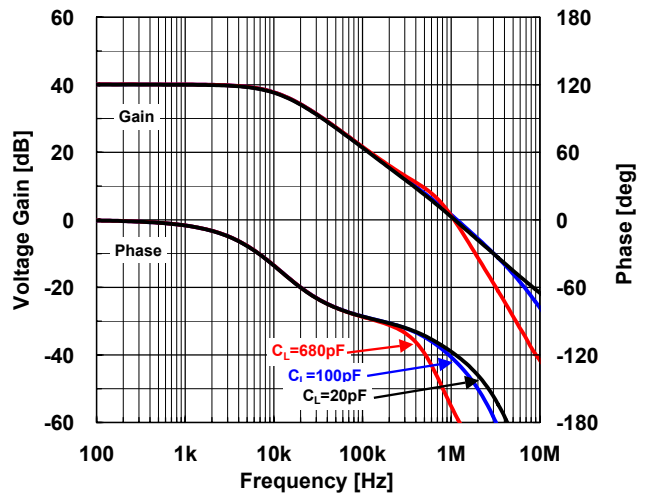
Maximum Output Voltage vs. Output Current
(Temperature)
 $V_{DD}=2.2V$



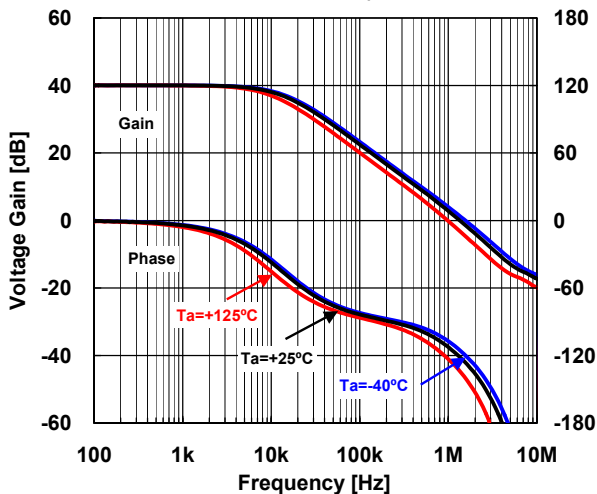
Gain/Phase vs. Frequency
 $V_{DD}=5V$, $G_v=40dB$, $R_F=100k\Omega$, $R_S=1k\Omega$
 $R_L=10k\Omega$, $T_a=25^\circ C$



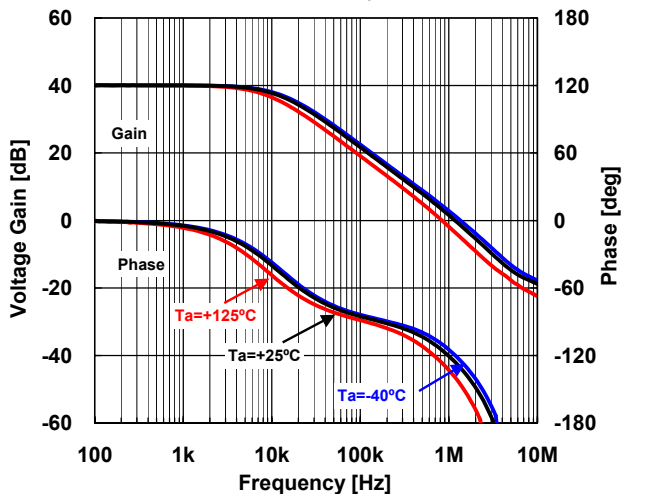
Gain/Phase vs. Frequency
 $V_{DD}=2.2V$, $G_v=40dB$, $R_F=100k\Omega$, $R_S=1k\Omega$
 $R_L=10k\Omega$, $T_a=25^\circ C$



Gain/Phase vs. Frequency (Temperature)
 $V_{DD}=5V$, $G_v=40dB$, $R_F=100k\Omega$, $R_S=1k\Omega$
 $R_L=10k\Omega$, $C_L=20pF$

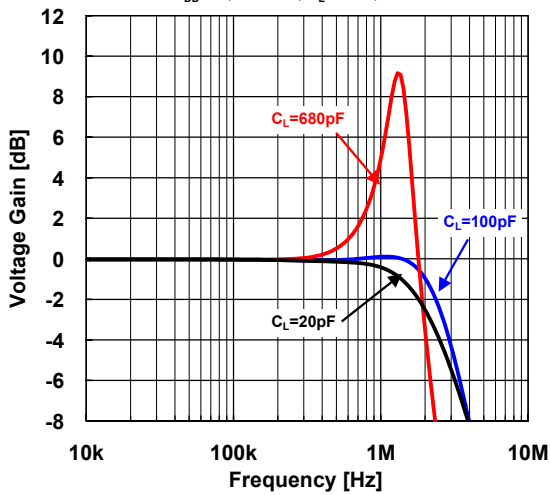


Gain/Phase vs. Frequency (Temperature)
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 $R_L=10k\Omega$, $C_L=20pF$

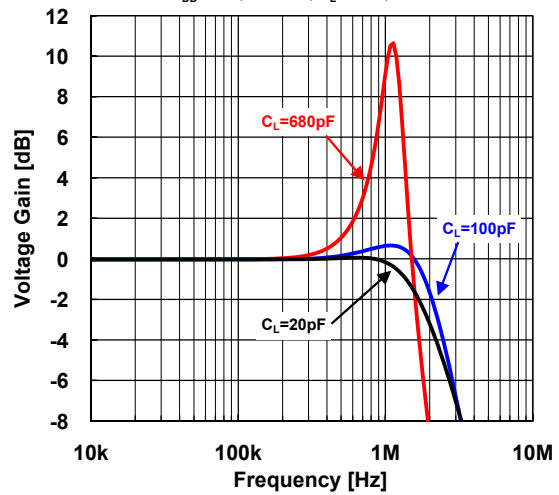


■ TYPICAL CHARACTERISTICS

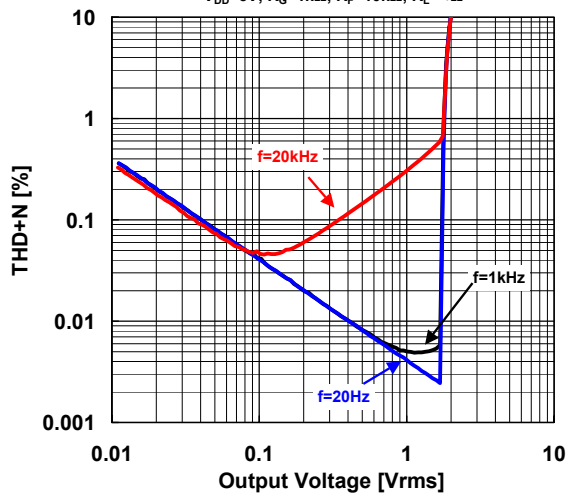
Gain vs. Frequency (Load Capacitance)
 $V_{DD}=5V$, $G_v=0dB$, $R_L=10k\Omega$, $T_a=25^\circ C$



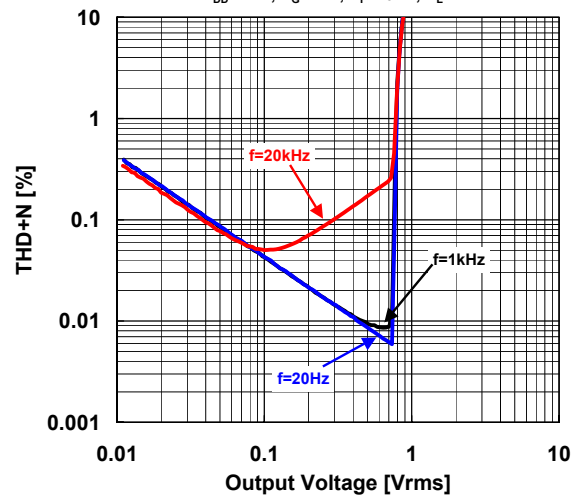
Gain vs. Frequency (Load Capacitance)
 $V_{DD}=2.2V$, $G_v=0dB$, $R_L=10k\Omega$, $T_a=25^\circ C$



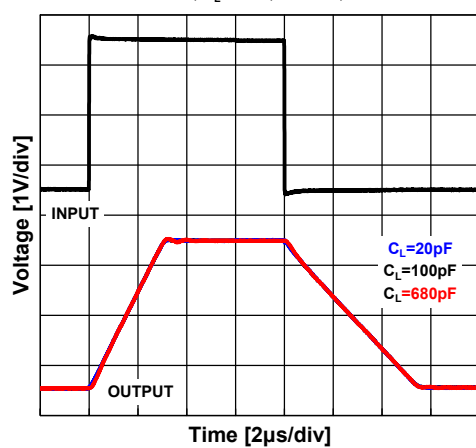
THD+N vs. Output Voltage
 $V_{DD}=5V$, $R_G=1k\Omega$, $R_F=10k\Omega$, $R_L=\infty\Omega$



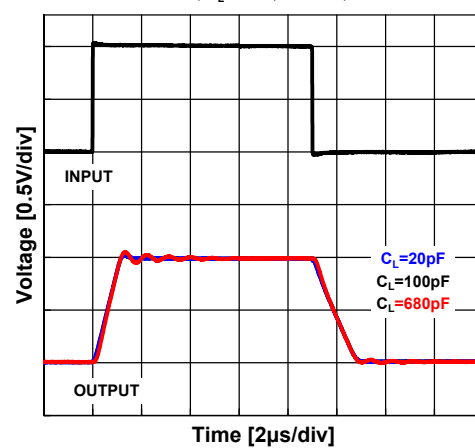
THD+N vs. Output Voltage
 $V_{DD}=2.2V$, $R_G=1k\Omega$, $R_F=10k\Omega$, $R_L=\infty\Omega$



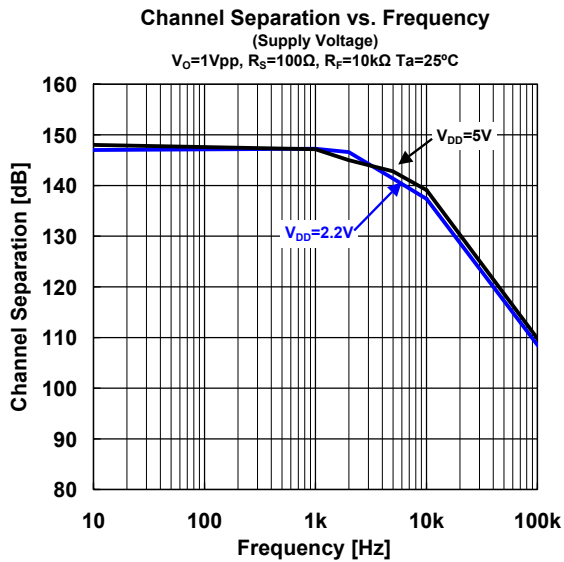
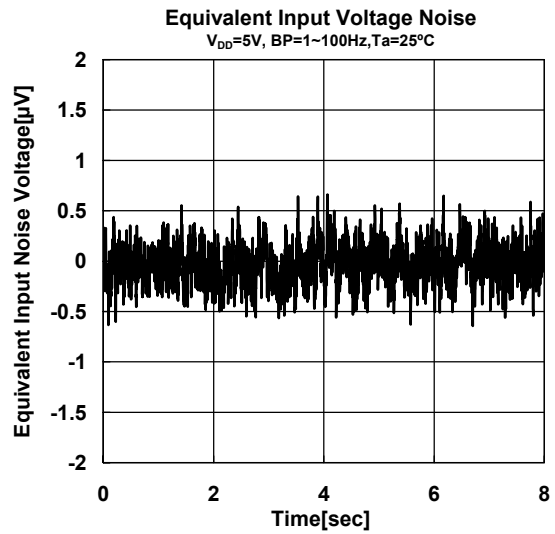
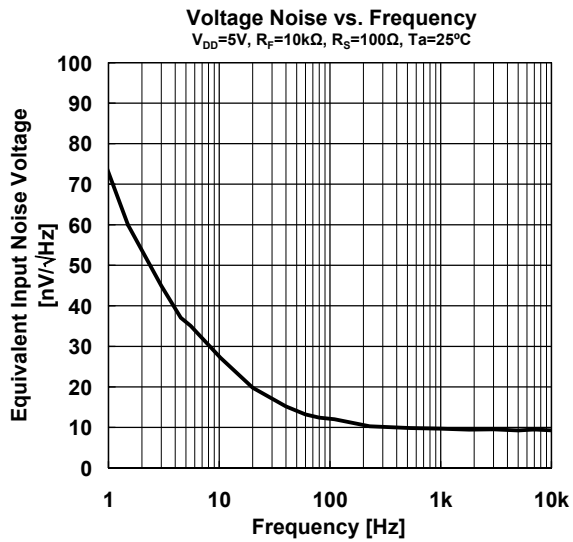
Pulse Response (Load Capacitance)
 $V^+/V^-=\pm 2.5V$, $R_L=10k\Omega$, $G_v=0dB$, $T_a=25^\circ C$



Pulse Response (Load Capacitance)
 $V^+/V^-=\pm 1.1V$, $R_L=10k\Omega$, $G_v=0dB$, $T_a=25^\circ C$



■ TYPICAL CHARACTERISTICS



[CAUTION]

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Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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