

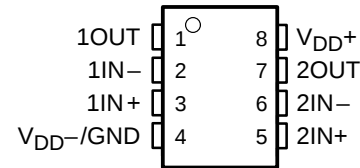
TLV2772, TLV2772A, TLV2772Y

2.7-V HIGH-SLEW-RATE RAIL-TO-RAIL OUTPUT DUAL OPERATIONAL AMPLIFIERS

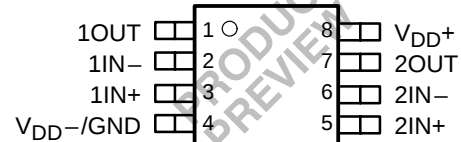
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- High Slew Rate . . . 10.5 V/ μ s Typ
- High-Gain Bandwidth . . . 5.1 MHz Typ
- Supply Voltage Range 2.7 V to 5 V
- Rail-to-Rail Output
- 360 μ V Input Offset Voltage
- Low Distortion Driving 600- Ω
0.005% THD+N
- 1 mA Supply Current (Per Channel)
- 17 nV/ $\sqrt{\text{Hz}}$ Input Noise Voltage
- 2 pA Input Bias Current
- Characterized from $T_A = -40^\circ\text{C}$ to 125°C
- Available in MSOP (DGK) Package

D OR P PACKAGE
(TOP VIEW)



DGK PACKAGE
(TOP VIEW)



description

The TLV2772 dual CMOS operational amplifier combines high slew rate and bandwidth, rail-to-rail output swing, high output drive and excellent dc precision. The device provides 10.5 V/ μ s of slew rate and 5.1 MHz of bandwidth while only consuming 1 mA of supply current per channel. This ac performance is much higher than current competitive CMOS amplifiers. The rail-to-rail output swing and high output drive makes this device a good choice for driving the analog input or reference of analog-to-digital converters. The device also has low distortion while driving a 600- Ω load for use in telecom systems.

The amplifier has a 360 μ V input offset voltage, a 17 nV/ $\sqrt{\text{Hz}}$ input noise voltage, and a 2 pA input bias current for measurement, medical, and industrial applications. The TLV2772 is also specified across an extended temperature range (-40°C to 125°C) making it useful for automotive systems.

The device operates from a 2.2 V to 5.5 V single supply voltage and is characterized at 2.7 V and 5 V. The single supply operation and low power consumption make this device a good solution for portable applications. It is available in an 8-pin PDIP, SOIC and ultra-low profile MSOP package.

AVAILABLE OPTIONS

T_A	$V_{IO\text{max}}$ AT 25°C	PACKAGED DEVICES			CHIP FORM [‡] (Y)
		SMALL OUTLINE [†] (D)	MSOP (DGK)	PLASTIC DIP (P)	
0°C to 70°C	2.5	TLV2772CD	TLV2772CDGK	TLV2772CP	TLV2772Y
-40°C to 125°C	2.5	TLV2772ID	TLV2772IDGK	TLV2772IP	
	1.6	TLV2772AID	TLV2772AIDGK	TLV2772AIP	

[†] The D packages are available taped and reeled. Add R suffix to the device type (e.g., TLV2772CDR).

[‡] Chip forms are tested at $T_A = 25^\circ\text{C}$ only.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

This document contains information on products in more than one phase of development. The status of each device is indicated on the page(s) specifying its electrical characteristics.

**TEXAS
INSTRUMENTS**

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TLV2772, TLV2772A, TLV2772Y

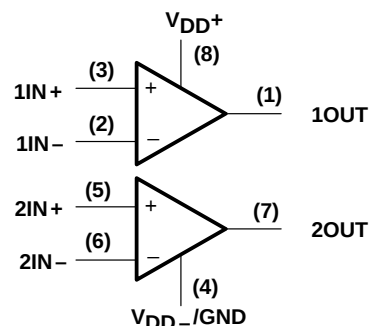
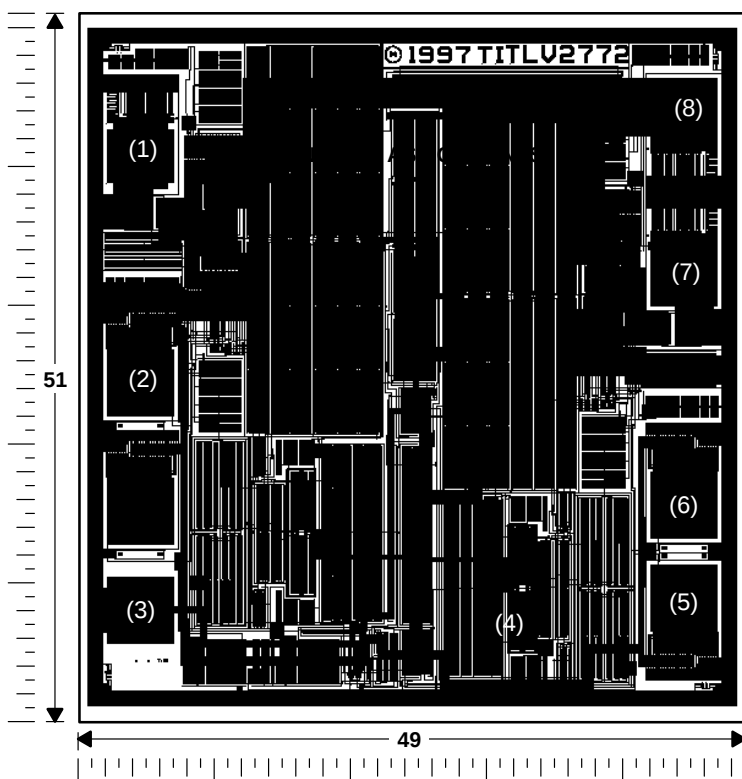
2.7-V HIGH-SLEW-RATE RAIL-TO-RAIL OUTPUT

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TLV2772Y chip information

This chip, when properly assembled, displays characteristics similar to the TLV2772. Thermal compression or ultrasonic bonding may be used on the doped-aluminum bonding pads. Chips may be mounted with conductive epoxy or a gold-silicon preform.



CHIP THICKNESS: 15 MILS TYPICAL

BONDING PADS: 4×4 MILS MINIMUM

$T_{jmax} = 150^{\circ}\text{C}$

TOLERANCES ARE $\pm 10\%$.

ALL DIMENSIONS ARE IN MILS.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

Supply voltage, V_{DD} (see Note 1)	7 V
Differential input voltage, V_{ID} (see Note 2)	$\pm V_{DD}$
Input voltage range, V_I (any input, see Note 1)	-0.3 V to V_{DD}
Input current, I_I (any input)	± 4 mA
Output current, I_O	± 50 mA
Total current into V_{DD+}	± 50 mA
Total current out of V_{DD-}	± 50 mA
Duration of short-circuit current (at or below) 25°C (see Note 3)	unlimited
Continuous total power dissipation	See Dissipation Rating Table
Operating free-air temperature range, T_A : C suffix	0°C to 70°C
I suffix	-40°C to 125°C
Storage temperature range, T_{stg}	-65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C

[†] Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES:
1. All voltage values, except differential voltages, are with respect to V_{DD-} .
 2. Differential voltages are at the noninverting input with respect to the inverting input. Excessive current flows when input is brought below $V_{DD-} - 0.3$ V.
 3. The output may be shorted to either supply. Temperature and/or supply voltages must be limited to ensure that the maximum dissipation rating is not exceeded.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$ POWER RATING	$T_A = 85^\circ\text{C}$ POWER RATING	$T_A = 125^\circ\text{C}$ POWER RATING
D	725 mW	5.8 mW/°C	464 mW	377 mW	145 mW
DGK	n/a	n/a	n/a	n/a	n/a
P	1000 mW	8.0 mW/°C	640 mW	520 mW	200 mW

recommended operating conditions

	C SUFFIX		I SUFFIX		UNIT
	MIN	MAX	MIN	MAX	
Supply voltage, V_{DD}	2.2	5.5	2.2	5.5	V
Input voltage range, V_I	V_{DD-}	$V_{DD+} - 1.3$	V_{DD-}	$V_{DD+} - 1.3$	V
Common-mode input voltage, V_{IC}	V_{DD-}	$V_{DD+} - 1.3$	V_{DD-}	$V_{DD+} - 1.3$	V
Operating free-air temperature, T_A	0	70	-40	125	°C

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electrical characteristics at specified free-air temperature, $V_{DD} = 2.7\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLV2772C			UNIT
			MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_{IC} = 0,$ $R_S = 50\ \Omega$ $V_O = 0,$	25°C		0.44	2.5	mV
		Full range		0.47	2.7	
α_{VIO} Temperature coefficient of input offset voltage		25°C to 125°C		2		$\mu\text{V}/^\circ\text{C}$
I_{IO} Input offset current		25°C		1		pA
		–40°C to 85°C		2	100	
I_{IB} Input bias current		25°C		2		pA
		–40°C to 85°C		6	100	
V_{ICR} Common-mode input voltage range	CMRR > 70 dB, $R_S = 50\ \Omega$	25°C	0 to 1.4	–0.3 to 1.7		V
		Full range	0 to 1.4	–0.3 to 1.7		
V_{OH} High-level output voltage	$I_{OH} = -0.675\text{ mA}$	25°C		2.6		V
		Full range		2.5		
	$I_{OH} = -2.2\text{ mA}$	25°C		2.4		
		Full range		2.1		
V_{OL} Low-level output voltage	$V_{IC} = 1.35\text{ V},$ $I_{OL} = 0.675\text{ mA}$	25°C		0.1		V
		Full range			0.2	
	$V_{IC} = 1.35\text{ V},$ $I_{OL} = 2.2\text{ mA}$	25°C		0.21		
		Full range			0.6	
A_{VD} Large-signal differential voltage amplification	$V_{IC} = 1.35\text{ V},$ $R_L = 10\text{ k}\Omega,$ $V_O = 0.6\text{ V to } 2.1\text{ V}$	25°C	20	380		V/mV
		Full range	13			
$r_{i(d)}$ Differential input resistance		25°C		10^{12}		Ω
$C_{i(c)}$ Common-mode input capacitance	$f = 10\text{ kHz}$	25°C		8		pF
z_o Closed-loop output impedance	$f = 100\text{ kHz},$ $A_V = 10$	25°C		25		Ω
$CMRR$ Common-mode rejection ratio	$V_{IC} = 0\text{ to } 1.5\text{ V},$ $R_S = 50\ \Omega$ $V_O = 1.5\text{ V},$	25°C	70	84		dB
		Full range	70	82		
k_{SVR} Supply voltage rejection ratio ($\Delta V_{DD} / \Delta V_{IO}$)	$V_{DD} = 2.7\text{ V to } 5\text{ V},$ $V_{IC} = V_{DD}/2,$ No load	25°C	70	89		dB
		Full range	70	84		
I_{DD} Supply current (per channel)	$V_O = 1.5\text{ V},$ No load	25°C		1	2	mA
		Full range			2	

† Full range is 0°C to 70°C.

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operating characteristics at specified free-air temperature, $V_{DD} = 2.7\text{ V}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T _A [†]	TLV2772C			UNIT	
					MIN	TYP	MAX		
SR	Slew rate at unity gain	V _O (PP) = 0.8 V, R _L = 10 kΩ		C _L = 100 pF	25°C	5	9	V/μs	
					Full range	4.7	6		
V _n	Equivalent input noise voltage	f = 10 Hz		25°C	147			nV/√Hz	
		f = 1 kHz		25°C	21				
V _N (PP)	Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 1 Hz		25°C	0.33			μV	
		f = 0.1 Hz to 10 Hz			0.86				
I _n	Equivalent input noise current	f = 100 Hz		25°C	1.5			pA/√Hz	
THD + N	Total harmonic distortion plus noise	R _L = 600 Ω, f = 1 kHz	A _V = 1	25°C	0.0085%				
			A _V = 10		0.025%				
			A _V = 100		0.12%				
Gain-bandwidth product		f = 10 kHz, C _L = 100 pF		R _L = 600 Ω,	25°C	4.8			MHz
t _s	Settling time	A _V = −1, Step = 0.85 V to 1.85 V, R _L = 600 Ω, C _L = 100 pF	0.1%	25°C	0.186			μs	
			0.01%	25°C	3.92				
φ _m	Phase margin at unity gain	R _L = 600 Ω, C _L = 100 pF		25°C	46°				
Gain margin				25°C	12			dB	

[†] Full range is 0°C to 70°C.

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electrical characteristics at specified free-air temperature, $V_{DD} = 2.7$ V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T _A [†]	TLV2772I			TLV2772AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V _{IO}	Input offset voltage	V _{IC} = 0, R _S = 50 Ω		V _O = 0,	25°C	0.44	2.5	0.44	1.6	mV	
	Full range				0.47	2.7	0.47	1.9			
α _{VIO}	Temperature coefficient of input offset voltage			25°C to 125°C	2		2		μV/°C		
I _{IO}	Input offset current			25°C	1		1				
				–40°C to 85°C	2	100	2	100	pA		
I _{IB}	Input bias current			25°C	2		2				
		–40°C to 85°C	6	100	6	100	pA				
V _{ICR}	Common-mode input voltage range	CMRR > 70 dB, R _S = 50 Ω		25°C	0 to 1.4	–0.3 to 1.7		0 to 1.4	–0.3 to 1.7	V	
				Full range	0 to 1.4	–0.3 to 1.7	0 to 1.4	–0.3 to 1.7			
V _{OH}	High-level output voltage	I _{OH} = –0.675 mA		25°C	2.6		2.6		V		
				Full range	2.5		2.5				
		I _{OH} = –2.2 mA		25°C	2.4		2.4				
				Full range	2.1		2.1				
V _{OL}	Low-level output voltage	V _{IC} = 1.35 V, I _{OL} = 0.675 mA		25°C	0.1		0.1		V		
				Full range	0.2		0.2				
		V _{IC} = 1.35 V, I _{OL} = 2.2 mA		25°C	0.21		0.21				
				Full range	0.6		0.6				
A _{VD}	Large-signal differential voltage amplification	V _{IC} = 1.35 V, V _O = 0.6 V to 2.1 V	R _L = 10 kΩ	25°C	20	380	20	380	V/mV		
				Full range	13		13				
r _{i(d)}	Differential input resistance			25°C	10 ¹²		10 ¹²		Ω		
c _{i(c)}	Common-mode input capacitance	f = 10 kHz,		25°C	8		8		pF		
z _o	Closed-loop output impedance	f = 100 kHz, A _V = 10		25°C	25		25		Ω		
CMRR	Common-mode rejection ratio	V _{IC} = 0 to 1.5 V, R _S = 50 Ω	V _O = 1.5 V,	25°C	70	84	70	84	dB		
				Full range	70	82	70	82			
k _{SVR}	Supply voltage rejection ratio (ΔV _{DD} /ΔV _{IO})	V _{DD} = 2.7 V to 5 V, No load	V _{IC} = V _{DD} /2,	25°C	70	89	70	89	dB		
				Full range	70	84	70	84			
I _{DD}	Supply current (per channel)	V _O = 1.5 V,	No load	25°C	1	2	1	2	mA		
				Full range	2		2				

† Full range is –40°C to 125°C.



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operating characteristics at specified free-air temperature, $V_{DD} = 2.7\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLV2772I			TLV2772AI			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
SR Slew rate at unity gain	$V_{O(PP)} = 0.8\text{ V}, \quad C_L = 100\text{ pF},$ $R_L = 10\text{ k}\Omega$	25°C	5	9		5	9		V/ μs
		Full range	4.7	6		4.7	6		
V_n Equivalent input noise voltage	$f = 10\text{ Hz}$	25°C		147			147		nV/ $\sqrt{\text{Hz}}$
	$f = 1\text{ kHz}$	25°C		21			21		
$V_{N(PP)}$ Peak-to-peak equivalent input noise voltage	$f = 0.1\text{ Hz to }1\text{ Hz}$	25°C		0.33			0.33		μV
	$f = 0.1\text{ Hz to }10\text{ Hz}$	25°C		0.86			0.86		μV
I_n Equivalent input noise current	$f = 100\text{ Hz}$	25°C		1.5			1.5		pA/ $\sqrt{\text{Hz}}$
THD + N Total harmonic distortion plus noise	$R_L = 600\ \Omega,$ $f = 1\text{ kHz}$	$A_V = 1$		0.0085%			0.0085%		
		$A_V = 10$		0.025%			0.025%		
		$A_V = 100$		0.12%			0.12%		
	Gain-bandwidth product	$f = 10\text{ kHz}, \quad R_L = 600\ \Omega,$ $C_L = 100\text{ pF}$	25°C	4.8			4.8		MHz
t_s Settling time	$A_V = -1,$ Step = 0.85 V to 1.85 V, $R_L = 600\ \Omega,$ $C_L = 100\text{ pF}$	0.1%	25°C	0.186			0.186		μs
		0.01%	25°C	3.92			3.92		
ϕ_m Phase margin at unity gain	$R_L = 600\ \Omega, \quad C_L = 100\text{ pF}$	25°C		46°			46°		
Gain margin		25°C		12			12		dB

[†] Full range is –40°C to 125°C.

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electrical characteristics at specified free-air temperature, $V_{DD} = 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLV2772C			UNIT
			MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_{IC} = 0,$ $R_S = 50\ \Omega$ $V_O = 0,$	25°C		0.36	2.5	mV
		Full range		0.4	2.7	
α_{VIO} Temperature coefficient of input offset voltage		25°C to 125°C		2		$\mu\text{V}/^\circ\text{C}$
I_{IO} Input offset current		25°C		1		pA
		–40°C to 85°C		2	100	
I_{IB} Input bias current		25°C		2		pA
		–40°C to 85°C		6	100	
V_{ICR} Common-mode input voltage range	CMRR > 60 dB, $R_S = 50\ \Omega$	25°C	0 to 3.7	–0.3 to 3.8		V
		Full range	0 to 3.7	–0.3 to 3.8		
V_{OH} High-level output voltage	$I_{OH} = -1.3\text{ mA}$	25°C		4.9		V
		Full range		4.8		
	$I_{OH} = -4.2\text{ mA}$	25°C		4.7		
		Full range		4.4		
V_{OL} Low-level output voltage	$V_{IC} = 2.5\text{ V},$ $I_{OL} = 1.3\text{ mA}$	25°C		0.1		V
		Full range			0.2	
	$V_{IC} = 2.5\text{ V},$ $I_{OL} = 4.2\text{ mA}$	25°C		0.21		
		Full range			0.6	
A_{VD} Large-signal differential voltage amplification	$V_{IC} = 2.5\text{ V},$ $R_L = 10\text{ k}\Omega,$ $V_O = 1\text{ V to }4\text{ V}$	25°C	20	450		V/mV
		Full range	13			
$r_{i(d)}$ Differential input resistance		25°C		10^{12}		Ω
$C_{i(c)}$ Common-mode input capacitance	$f = 10\text{ kHz}$	25°C		8		pF
z_o Closed-loop output impedance	$f = 100\text{ kHz},$ $A_V = 10$	25°C		20		Ω
$CMRR$ Common-mode rejection ratio	$V_{IC} = 0\text{ to }3.7\text{ V},$ $R_S = 50\ \Omega$ $V_O = 3.7\text{ V},$	25°C	60	96		dB
		Full range	60	93		
k_{SVR} Supply voltage rejection ratio ($\Delta V_{DD} / \Delta V_{IO}$)	$V_{DD} = 2.7\text{ V to }5\text{ V},$ $V_{IC} = V_{DD}/2,$ No load	25°C	70	89		dB
		Full range	70	84		
I_{DD} Supply current (per channel)	$V_O = 1.5\text{ V},$ No load	25°C		1	2	mA
		Full range			2	

† Full range is 0°C to 70°C.

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operating characteristics at specified free-air temperature, $V_{DD} = 5\text{ V}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T _A [†]	TLV2772C			UNIT
					MIN	TYP	MAX	
SR	Slew rate at unity gain	V _{O(PP)} = 1.5 V, R _L = 10 kΩ	C _L = 100 pF,	25°C	5	10.5	V/μs	
				Full range	4.7	6		
V _n	Equivalent input noise voltage	f = 10 Hz		25°C	147		nV/√Hz	
		f = 1 kHz		25°C	17			
V _{N(PP)}	Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 1 Hz		25°C	0.33		μV	
		f = 0.1 Hz to 10 Hz			0.86			
I _n	Equivalent input noise current	f = 100 Hz		25°C	0.2		pA/√Hz	
THD + N	Total harmonic distortion plus noise	R _L = 600 Ω, f = 1 kHz	A _V = 1	25°C	0.005%			
			A _V = 10		0.016%			
			A _V = 100		0.095%			
Gain-bandwidth product		f = 10 kHz, C _L = 100 pF		25°C	5.1		MHz	
t _s	Settling time	A _V = −1, Step = 1.5 V to 3.5 V, R _L = 600 Ω, C _L = 100 pF	0.1%	25°C	0.134		μs	
			0.01%	25°C	1.97			
φ _m	Phase margin at unity gain	R _L = 600 Ω,		25°C	46°			
Gain margin		C _L = 100 pF			25°C	12		dB

[†] Full range is 0°C to 70°C.

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electrical characteristics at specified free-air temperature, $V_{DD} = 5\text{ V}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T _A [†]	TLV2772I			TLV2772AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V _{IO}	Input offset voltage	V _{IC} = 0, R _S = 50 Ω		V _O = 0,	25°C	0.36	2.5	0.36	1.6	mV	
	Full range				0.4	2.7	0.4	1.9			
α _{VIO}	Temperature coefficient of input offset voltage				25°C to 125°C	2	2	μV/°C			
I _{IO}	Input offset current				25°C	1	1	pA			
					–40°C to 85°C	2	100		2	100	
I _{IB}	Input bias current				25°C	2	2	pA			
		–40°C to 85°C	6	100	6	100					
V _{ICR}	Common-mode input voltage range	CMRR > 60 dB, R _S = 50 Ω		25°C	0 to 3.7	–0.3 to 3.8	0 to 3.7	–0.3 to 3.8	V		
				Full range	0 to 3.7	–0.3 to 3.8	0 to 3.7	–0.3 to 3.8			
V _{OH}	High-level output voltage	I _{OH} = –1.3 mA		25°C	4.9		4.9		V		
				Full range	4.8		4.8				
		I _{OH} = –4.2 mA		25°C	4.7		4.7				
				Full range	4.4		4.4				
V _{OL}	Low-level output voltage	V _{IC} = 2.5 V, I _{OL} = 1.3 mA		25°C	0.1		0.1		V		
				Full range	0.2		0.2				
		V _{IC} = 2.5 V, I _{OL} = 4.2 mA		25°C	0.21		0.21				
				Full range	0.6		0.6				
A _{VD}	Large-signal differential voltage amplification	V _{IC} = 2.5 V, V _O = 1 V to 4 V	R _L = 10 kΩ	25°C	20	450	20	450	V/mV		
				Full range	13		13				
r _{i(d)}	Differential input resistance			25°C	10 ¹²		10 ¹²		Ω		
c _{i(c)}	Common-mode input capacitance	f = 10 kHz,		25°C	8		8		pF		
z _o	Closed-loop output impedance	f = 100 kHz,	A _V = 10	25°C	20		20		Ω		
CMRR	Common-mode rejection ratio	V _{IC} = 0 to 3.7 V, R _S = 50 Ω	V _O = 3.7 V,	25°C	60	96	60	96	dB		
				Full range	60	93	60	93			
k _{SVR}	Supply voltage rejection ratio (ΔV _{DD} /ΔV _{IO})	V _{DD} = 2.7 V to 5 V, No load	V _{IC} = V _{DD} /2,	25°C	70	89	70	89	dB		
				Full range	70	84	70	84			
I _{DD}	Supply current (per channel)	V _O = 1.5 V,	No load	25°C	1	2	1	2	mA		
				Full range	2		2				

† Full range is –40°C to 125°C.



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operating characteristics at specified free-air temperature, $V_{DD} = 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLV2772I			TLV2772AI			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
SR Slew rate at unity gain	$V_{O(PP)} = 1.5\text{ V}$, $C_L = 100\text{ pF}$, $R_L = 10\text{ k}\Omega$	25°C	5	10.5		5	10.5		V/ μs
		Full range	4.7	6		4.7	6		
V_n Equivalent input noise voltage	$f = 10\text{ Hz}$	25°C		147			147		nV/ $\sqrt{\text{Hz}}$
	$f = 1\text{ kHz}$	25°C		17			17		
$V_{N(PP)}$ Peak-to-peak equivalent input noise voltage	$f = 0.1\text{ Hz to }1\text{ Hz}$	25°C		0.33			0.33		μV
	$f = 0.1\text{ Hz to }10\text{ Hz}$	25°C		0.86			0.86		μV
I_n Equivalent input noise current	$f = 100\text{ Hz}$	25°C		0.2			0.2		pA/ $\sqrt{\text{Hz}}$
THD + N Total harmonic distortion plus noise	$R_L = 600\text{ }\Omega$, $f = 1\text{ kHz}$	$A_V = 1$		0.005%			0.005%		
		$A_V = 10$		0.016%			0.016%		
		$A_V = 100$		0.095%			0.095%		
	Gain-bandwidth product	$f = 10\text{ kHz}$, $R_L = 600\text{ }\Omega$, $C_L = 100\text{ pF}$	25°C	5.1			5.1		MHz
t_s Settling time	$A_V = -1$, Step = 1.5 V to 3.5 V, $R_L = 600\text{ }\Omega$, $C_L = 100\text{ pF}$	0.1%	25°C	0.134			0.134		μs
		0.01%	25°C	1.97			1.97		
ϕ_m Phase margin at unity gain	$R_L = 600\text{ }\Omega$, $C_L = 100\text{ pF}$	25°C		46°			46°		
Gain margin		25°C		12			12		dB

[†] Full range is –40°C to 125°C.

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electrical characteristics at specified free-air temperature, $V_{DD} = 2.7\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		TLV2772Y			UNIT
				MIN	TYP	MAX	
V _{IO}	Input offset voltage	V _{IC} = 0, R _S = 50 Ω	V _O = 0,	0.44			mV
I _{IO}	Input offset current			1			pA
I _{IB}	Input bias current			2			pA
V _{ICR}	Common-mode input voltage range	CMRR > 70 dB,	R _S = 50 Ω	−0.3 to 1.7			V
V _{OH}	High-level output voltage	I _{OH} = −0.675 mA		2.6			V
		I _{OH} = −2.2 mA		2.4			
V _{OL}	Low-level output voltage	V _{IC} = 1.35 V, I _{OL} = 0.675 mA		0.1			V
		V _{IC} = 1.35 V, I _{OL} = 2.2 mA		0.21			
A _{VD}	Large-signal differential voltage amplification	V _{IC} = 1.35 V, V _O = 0.6 V to 2.1 V		380			V/mV
r _{i(d)}	Differential input resistance			10 ¹²			Ω
c _{i(c)}	Common-mode input capacitance	f = 10 kHz		8			pF
z _O	Closed-loop output impedance	f = 100 kHz, A _V = 10		25			Ω
CMRR	Common-mode rejection ratio	V _{IC} = 0 to 1.5 V, R _S = 50 Ω		84			dB
k _{SVR}	Supply voltage rejection ratio (ΔV _{DD} /ΔV _{IO})	V _{DD} = 2.7 V to 5 V, No load		89			dB
I _{DD}	Supply current (per channel)	V _O = 1.5 V, No load		1			mA

operating characteristics at specified free-air temperature, $V_{DD} = 2.7\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		TLV2772Y			UNIT
				MIN	TYP	MAX	
SR	Slew rate at unity gain	V _{O(PP)} = 0.8 V, C _L = 100 pF, R _L = 10 kΩ		9			V/μs
V _n	Equivalent input noise voltage	f = 10 Hz		147			nV/√Hz
		f = 1 kHz		21			
V _{N(PP)}	Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 1 Hz		0.33			μV
		f = 0.1 Hz to 10 Hz		0.86			
I _n	Equivalent input noise current	f = 100 Hz		1.5			pA/√Hz
THD + N	Total harmonic distortion plus noise	R _L = 600 Ω, f = 1 kHz	A _V = 1	0.0085%			
			A _V = 10	0.025%			
			A _V = 100	0.12%			
Gain-bandwidth product		f = 10 kHz, R _L = 600 Ω, C _L = 100 pF		4.8			MHz
t _s	Settling time	A _V = −1, Step = 0.85 V to 1.85 V, R _L = 600 Ω, C _L = 100 pF	0.1%	0.186			μs
			0.01%	3.92			
φ _m	Phase margin at unity gain	R _L = 600 Ω, C _L = 100 pF		46°			
Gain margin				12			dB



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electrical characteristics at specified free-air temperature, $V_{DD} = 5\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS	TLV2772Y			UNIT
			MIN	TYP	MAX	
V _{IO}	Input offset voltage	V _{IC} = 0, R _S = 50 Ω	V _O = 0,		0.36	mV
I _{IO}	Input offset current				1	pA
I _{IB}	Input bias current				2	pA
V _{ICR}	Common-mode input voltage range	CMRR > 60 dB,	R _S = 50 Ω		−0.3 to 3.8	V
V _{OH}	High-level output voltage	I _{OH} = −1.3 mA		4.9	V	
		I _{OH} = −4.2 mA		4.7		
V _{OL}	Low-level output voltage	V _{IC} = 2.5 V, I _{OL} = 1.3 mA		0.1	V	
		V _{IC} = 2.5 V, I _{OL} = 4.2 mA		0.21		
A _{VD}	Large-signal differential voltage amplification	V _{IC} = 2.5 V, V _O = 1 V to 4 V	R _L = 10 kΩ,		450	V/mV
r _{i(d)}	Differential input resistance				10 ¹²	Ω
c _{i(c)}	Common-mode input capacitance	f = 10 kHz			8	pF
z _o	Closed-loop output impedance	f = 100 kHz,	A _V = 10		20	Ω
CMRR	Common-mode rejection ratio	V _{IC} = 0 to 3.7 V, R _S = 50 Ω	V _O = 3.7 V,		96	dB
k _{SVR}	Supply voltage rejection ratio (ΔV _{DD} /ΔV _{IO})	V _{DD} = 2.7 V to 5 V, No load	V _{IC} = V _{DD} /2,		89	dB
I _{DD}	Supply current (per channel)	V _O = 1.5 V,	No load		1	mA

operating characteristics at specified free-air temperature, $V_{DD} = 5\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		TLV2772Y			UNIT
				MIN	TYP	MAX	
SR	Slew rate at unity gain	V _{O(PP)} = 1.5 V, C _L = 100 pF, R _L = 10 kΩ		10.5			V/μs
V _n	Equivalent input noise voltage	f = 10 Hz		147			nV/√Hz
		f = 1 kHz		17			
V _{N(PP)}	Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 1 Hz		0.33			μV
		f = 0.1 Hz to 10 Hz		0.86			
I _n	Equivalent input noise current	f = 100 Hz		0.2			pA/√Hz
THD + N	Total harmonic distortion plus noise	R _L = 600 Ω, f = 1 kHz	A _V = 1	0.005%			
			A _V = 10	0.016%			
			A _V = 100	0.095%			
Gain-bandwidth product		f = 10 kHz, R _L = 600 Ω, C _L = 100 pF		5.1			MHz
t _s	Settling time	A _V = −1, Step = 1.5 V to 3.5 V, R _L = 600 Ω, C _L = 100 pF	0.1%	0.134			μs
			0.01%	1.97			
φ _m	Phase margin at unity gain	R _L = 600 Ω, C _L = 100 pF		46°			
Gain margin				12			dB



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THD + N	Total harmonic distortion plus noise	vs Frequency	42,43
		Gain-bandwidth product	vs Supply voltage
B_1	Unity-gain bandwidth	vs Load capacitance	45
ϕ_m	Phase margin	vs Load capacitance	46
	Gain margin	vs Load capacitance	47

TYPICAL CHARACTERISTICS

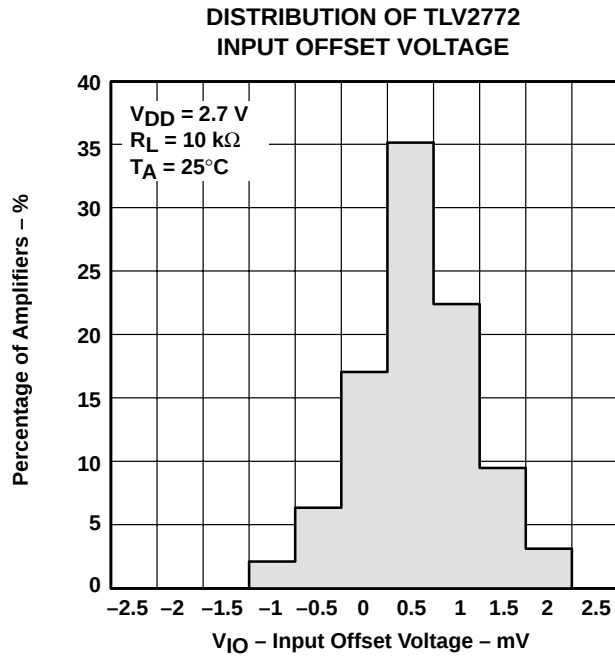


Figure 1

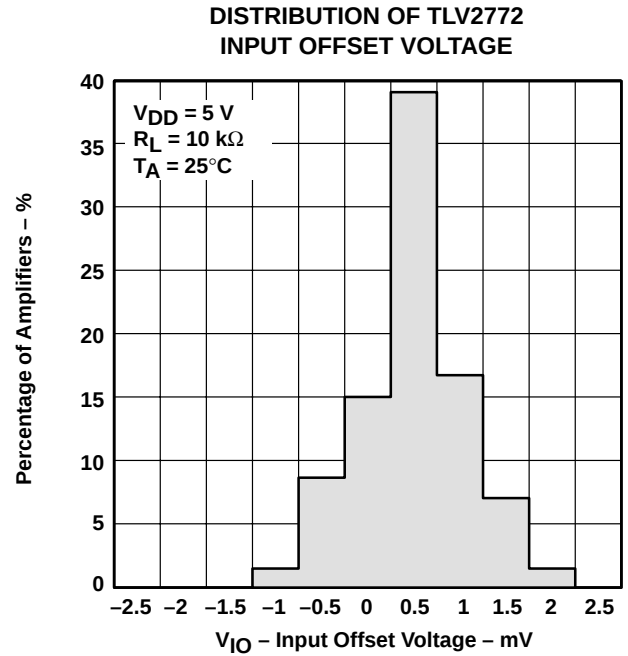


Figure 2

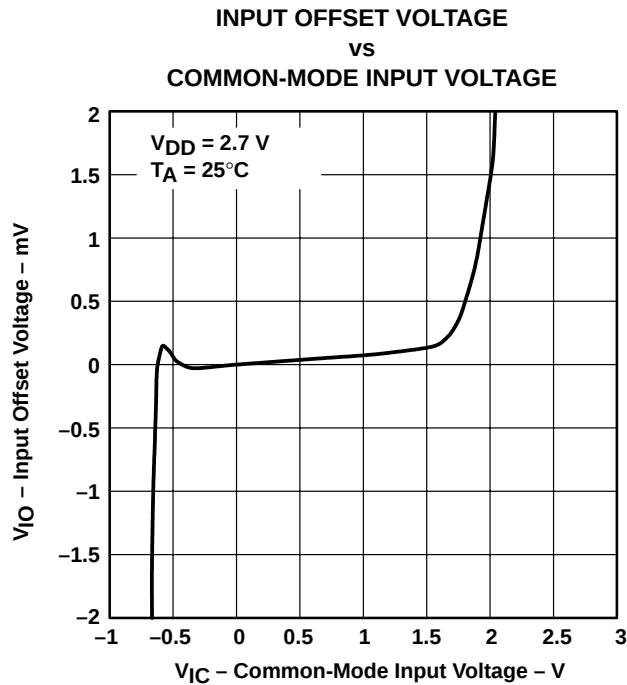


Figure 3

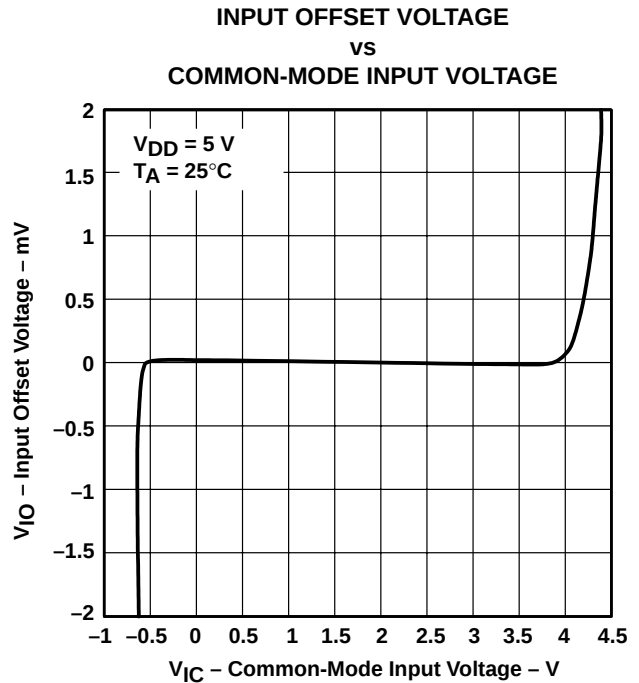


Figure 4

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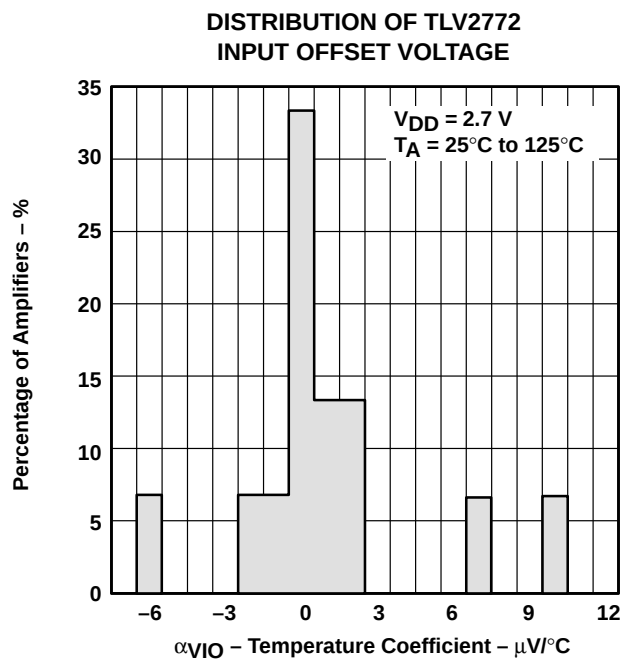


Figure 5

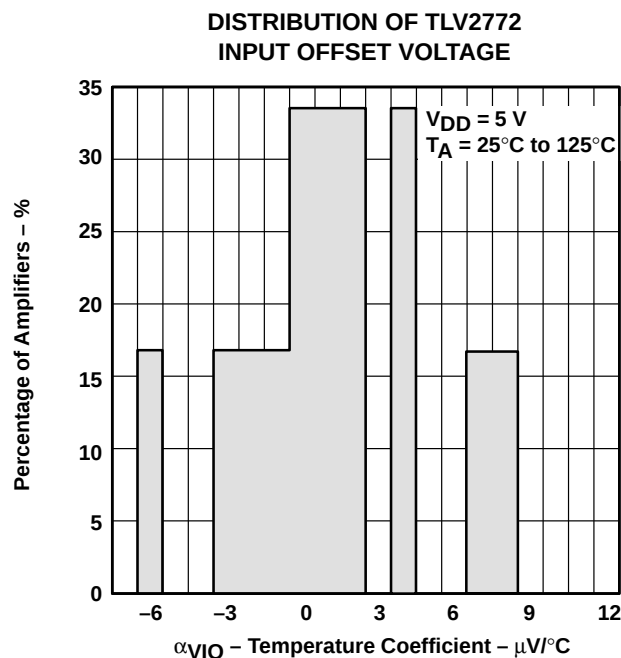


Figure 6

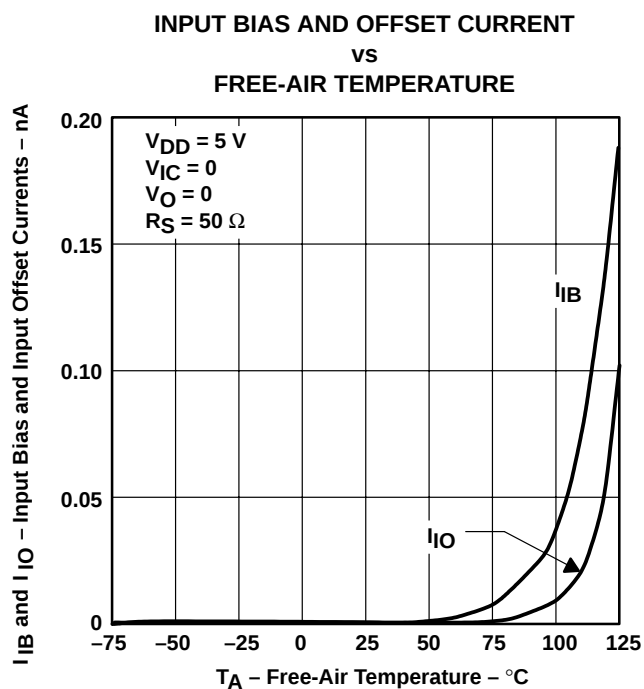


Figure 7

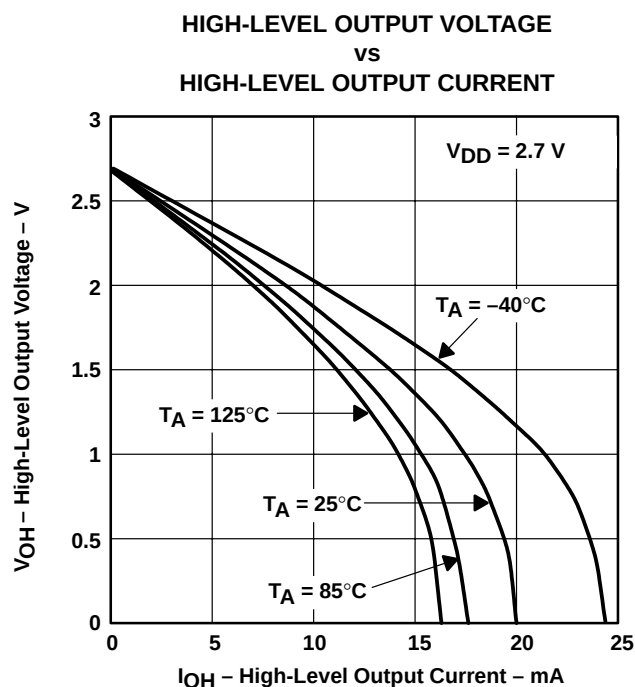


Figure 8

TYPICAL CHARACTERISTICS

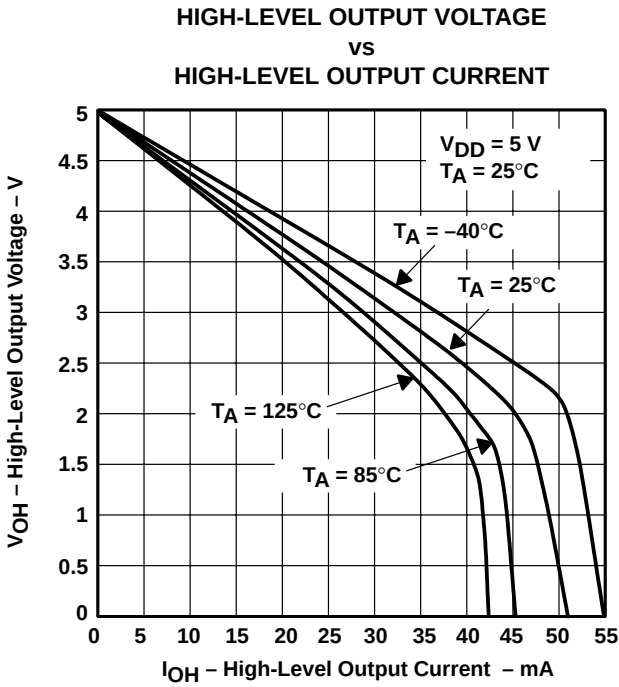


Figure 9

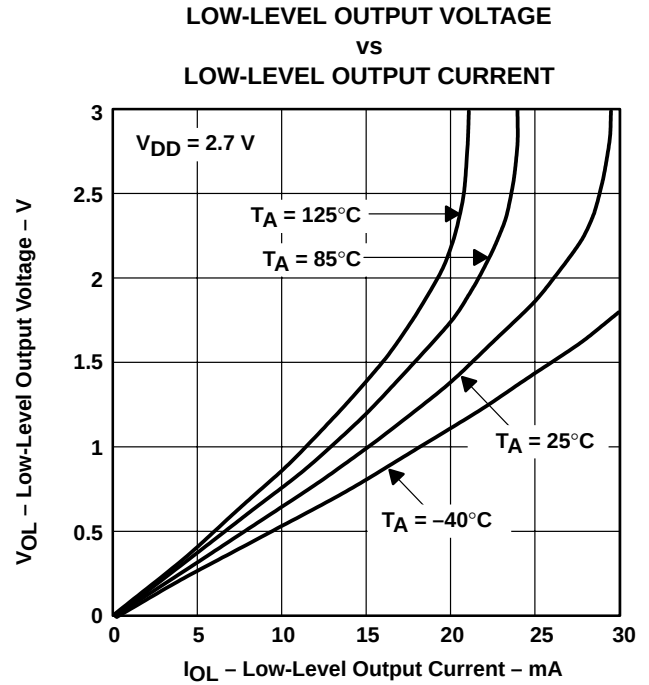


Figure 10

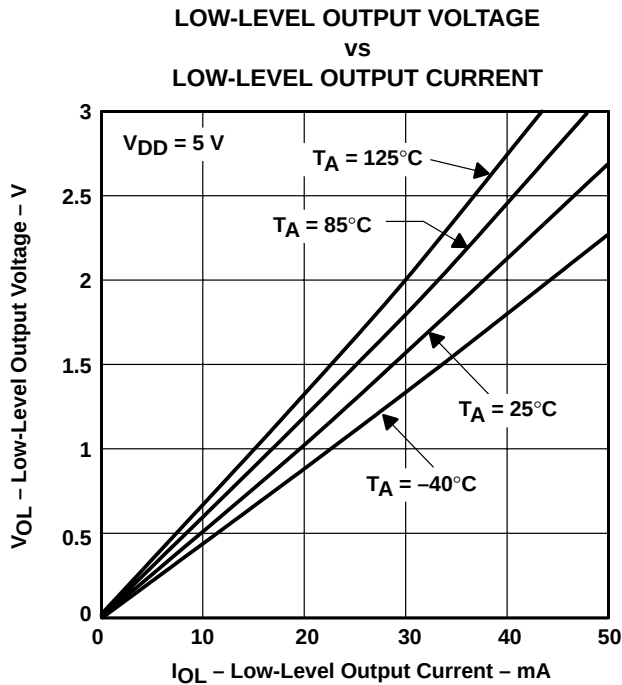


Figure 11

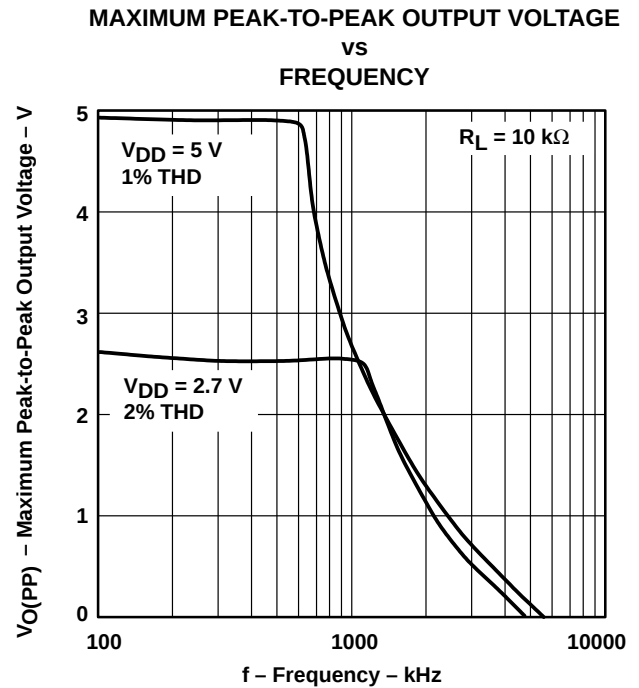


Figure 12

TLV2772, TLV2772A, TLV2772Y

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MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE
vs
FREQUENCY

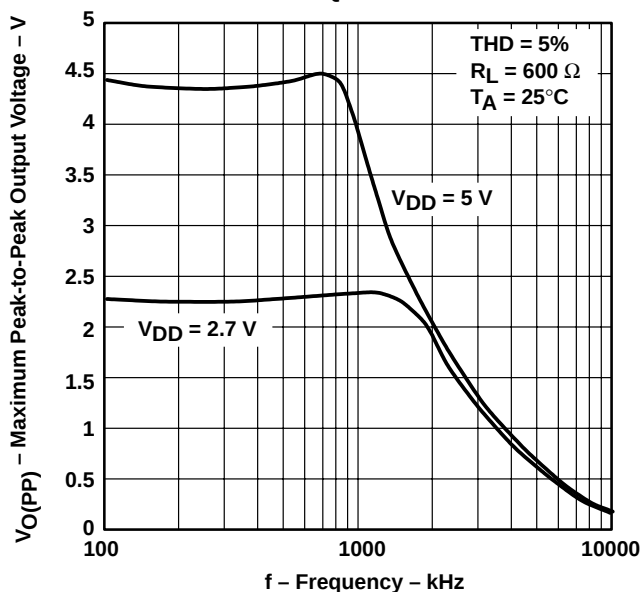


Figure 13

SHORT-CIRCUIT OUTPUT CURRENT
vs
SUPPLY VOLTAGE

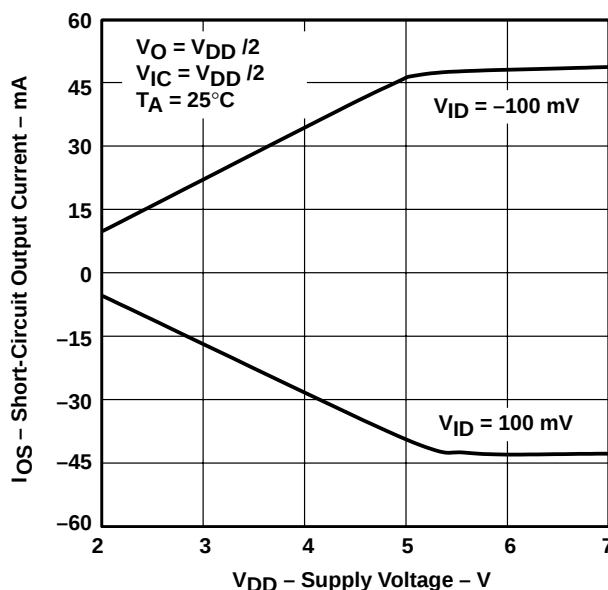


Figure 14

SHORT-CIRCUIT OUTPUT CURRENT
vs
FREE-AIR TEMPERATURE

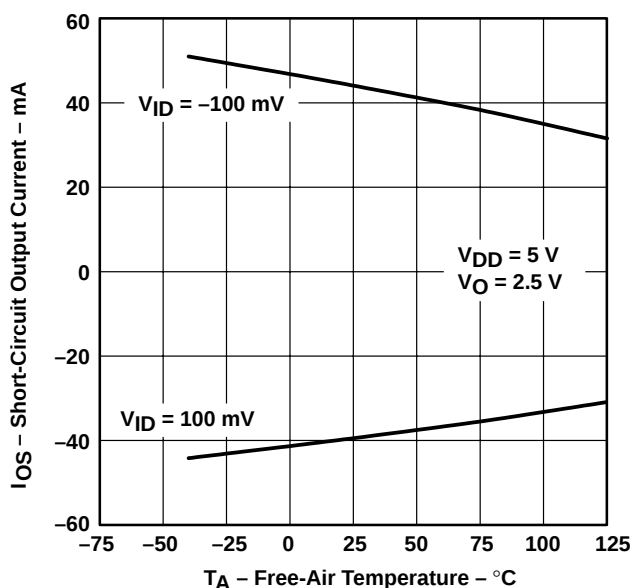


Figure 15

OUTPUT VOLTAGE
vs
DIFFERENTIAL INPUT VOLTAGE

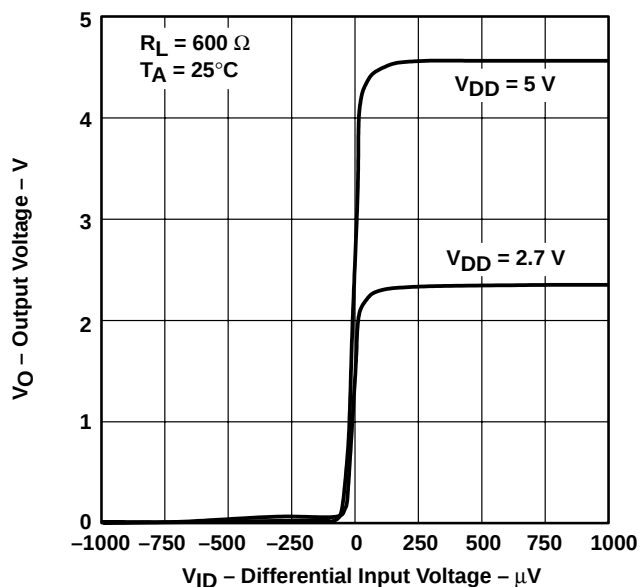


Figure 16

TYPICAL CHARACTERISTICS

LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE MARGIN VS FREQUENCY

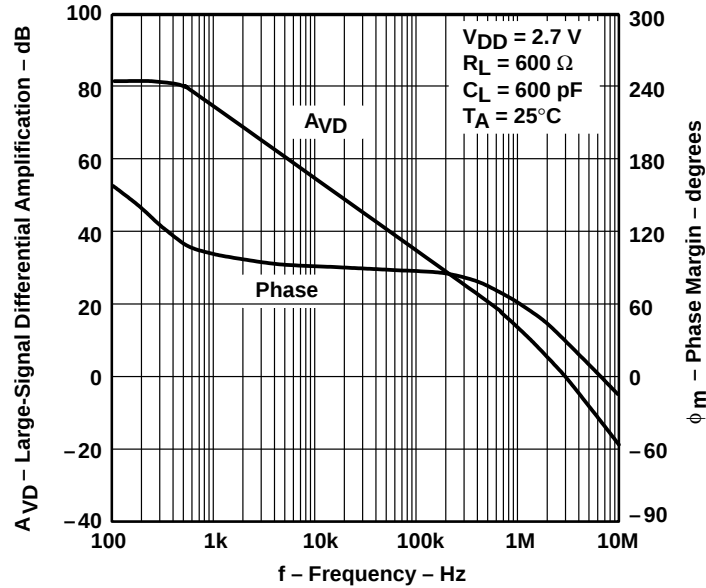


Figure 17

LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE MARGIN VS FREQUENCY

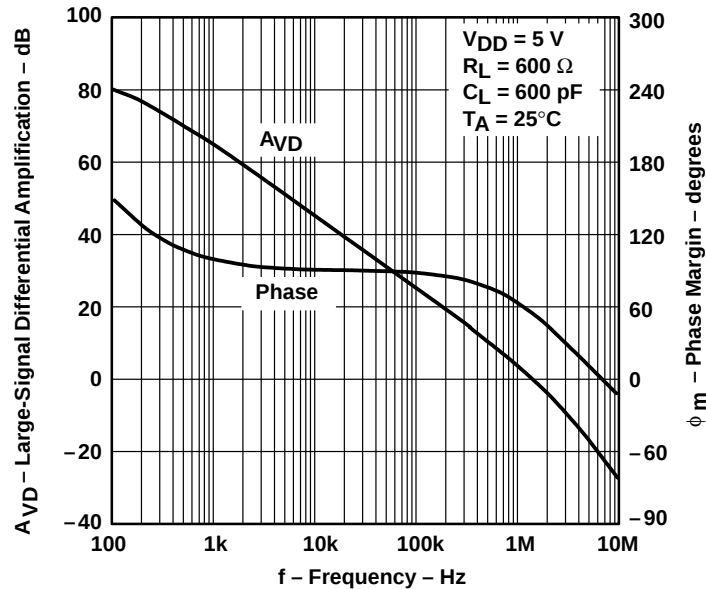


Figure 18

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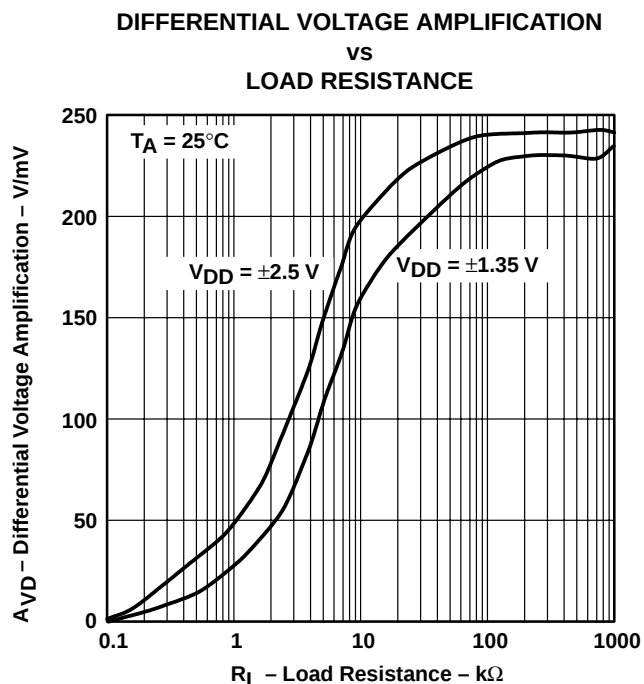


Figure 19

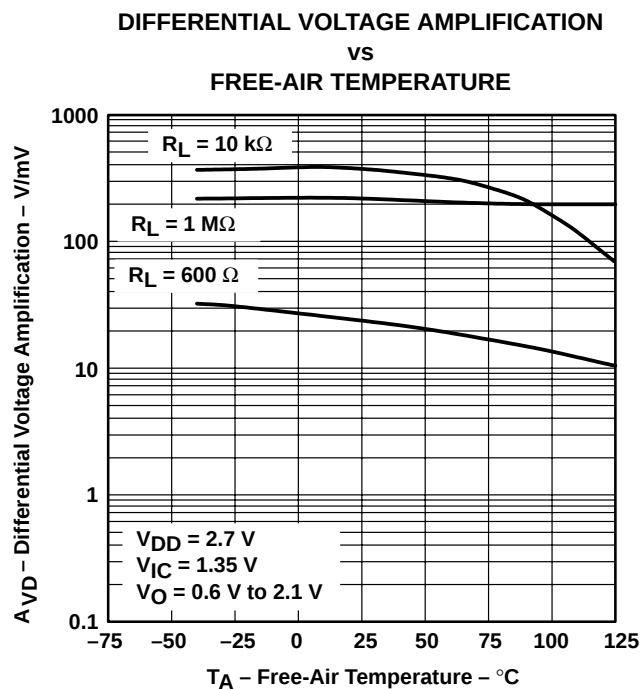


Figure 20

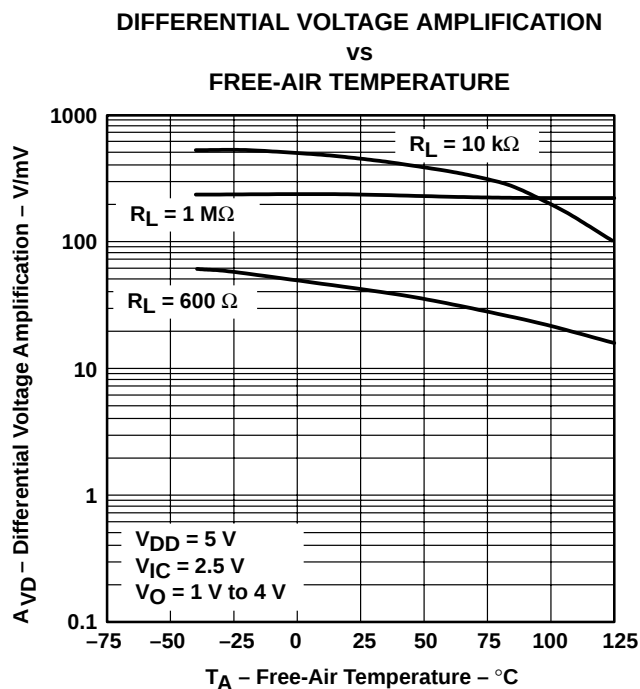


Figure 21

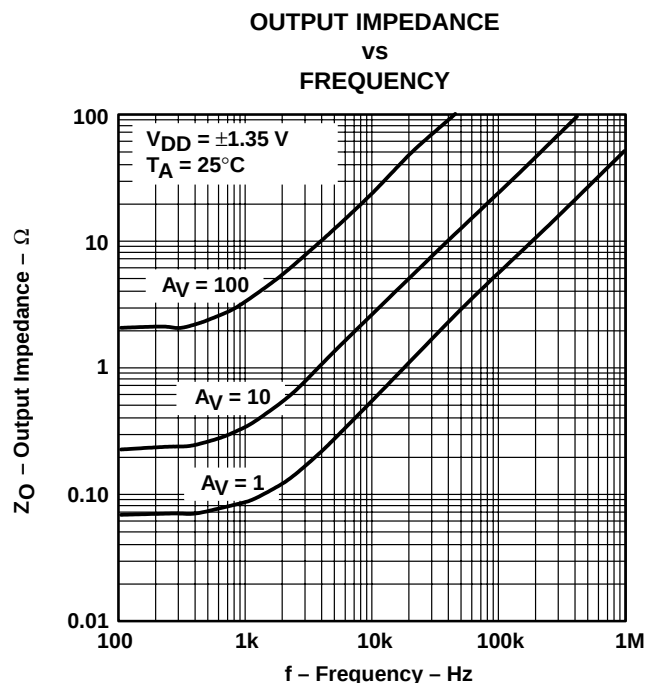


Figure 22

TYPICAL CHARACTERISTICS

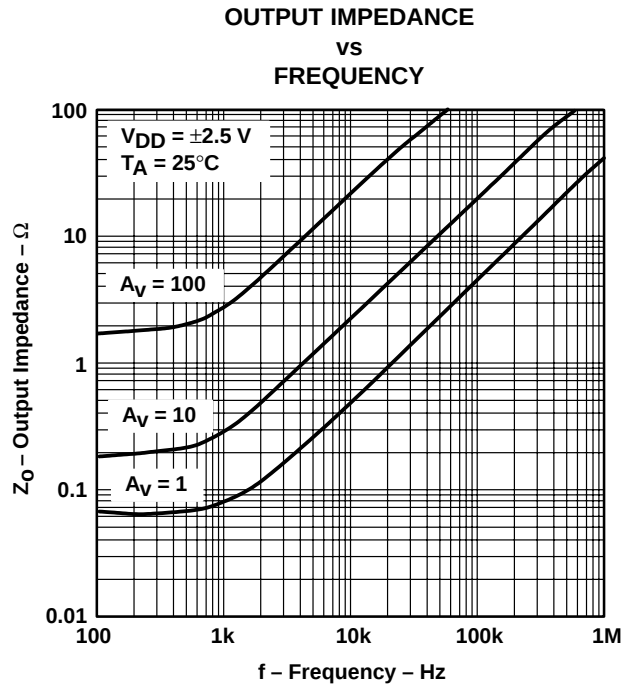


Figure 23

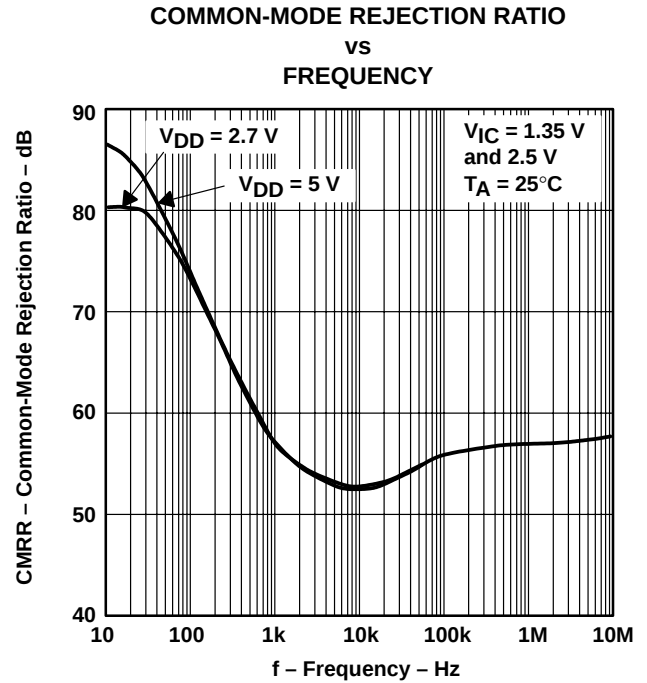


Figure 24

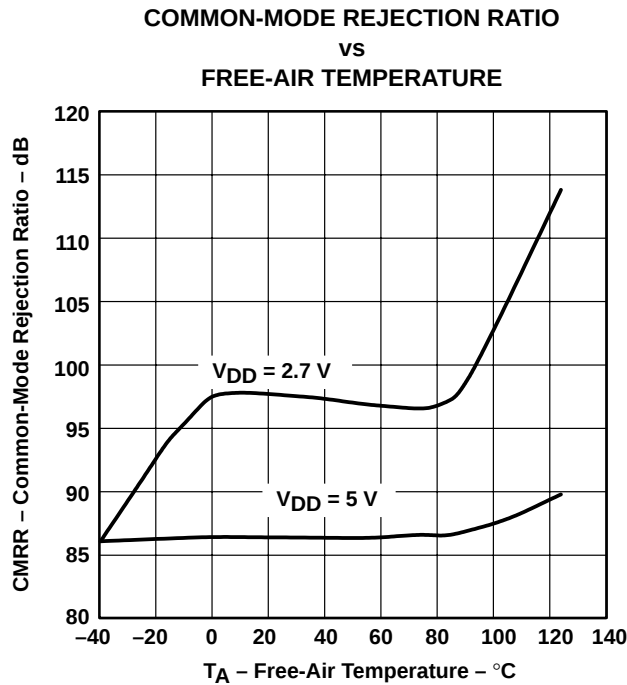


Figure 25

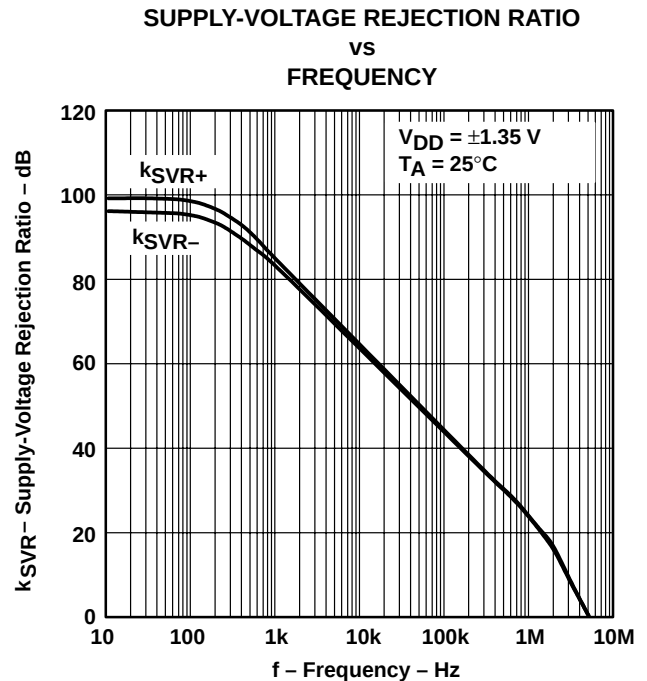


Figure 26

TLV2772, TLV2772A, TLV2772Y

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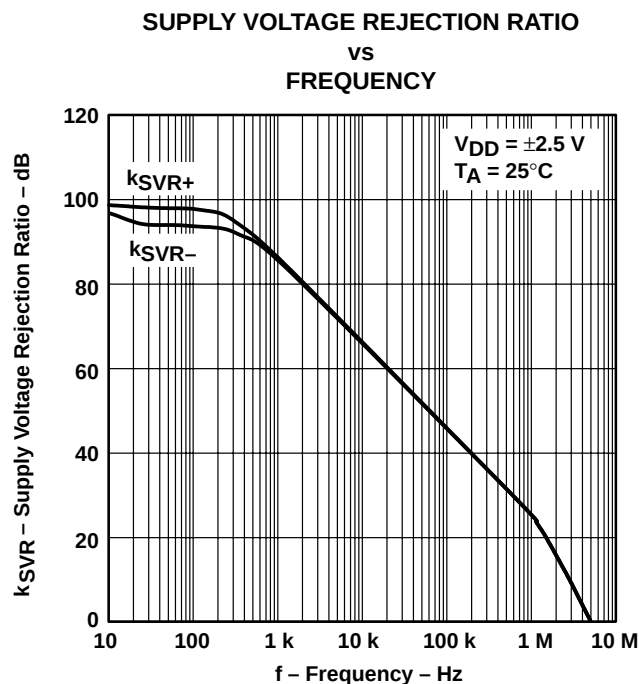


Figure 27

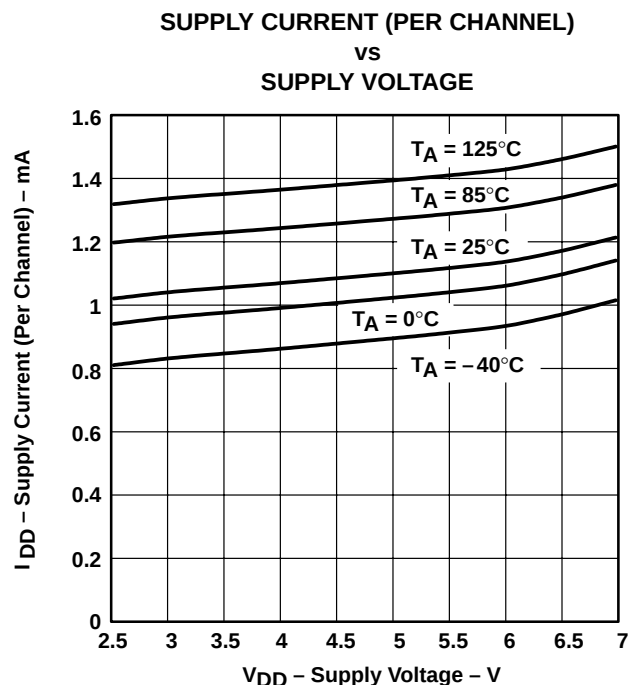


Figure 28

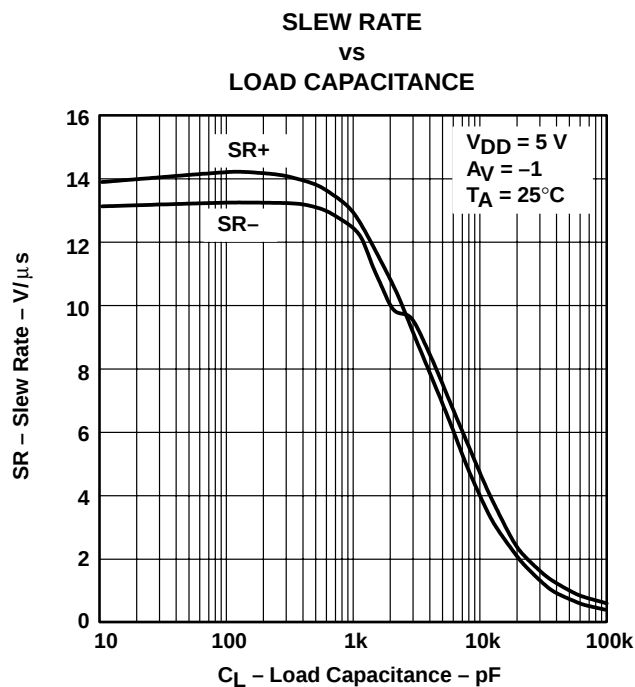


Figure 29

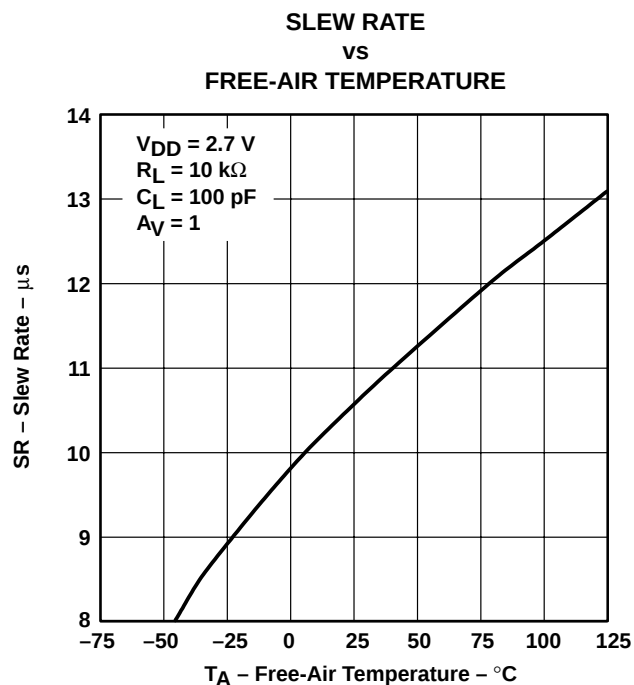


Figure 30

TYPICAL CHARACTERISTICS

VOLTAGE-FOLLOWER
SMALL-SIGNAL PULSE RESPONSE

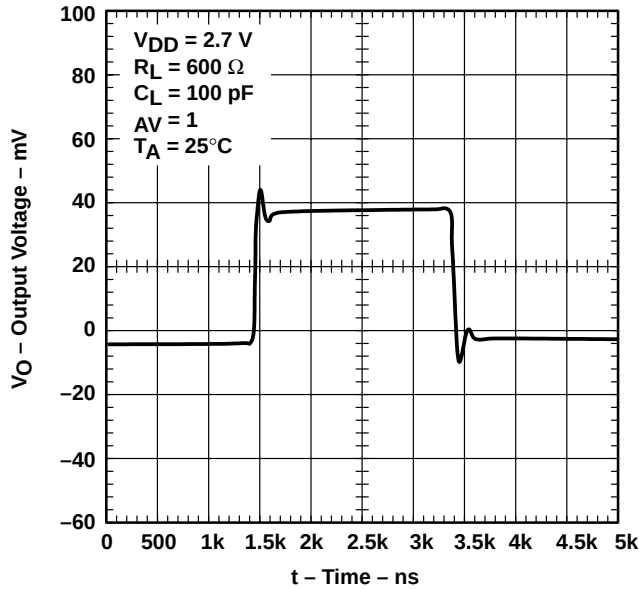


Figure 31

VOLTAGE-FOLLOWER
SMALL-SIGNAL PULSE RESPONSE

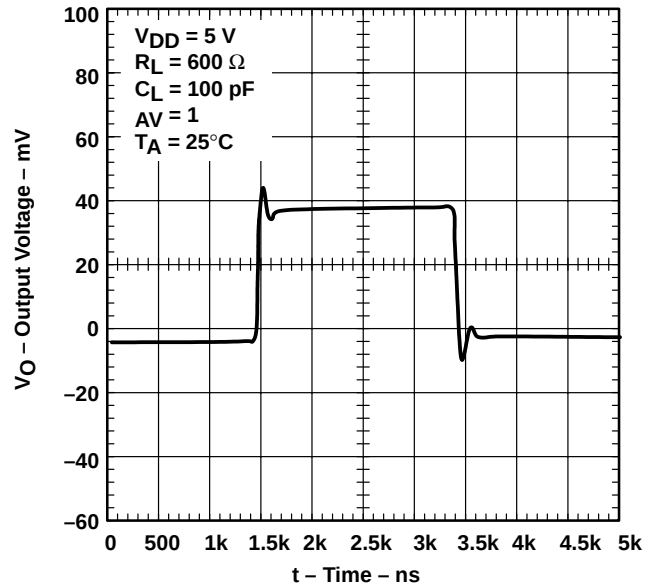


Figure 32

VOLTAGE-FOLLOWER
LARGE-SIGNAL PULSE RESPONSE

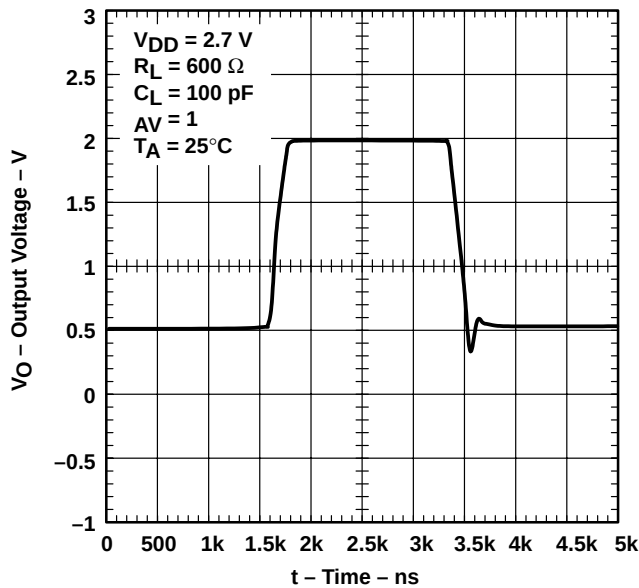


Figure 33

VOLTAGE-FOLLOWER
LARGE-SIGNAL PULSE RESPONSE

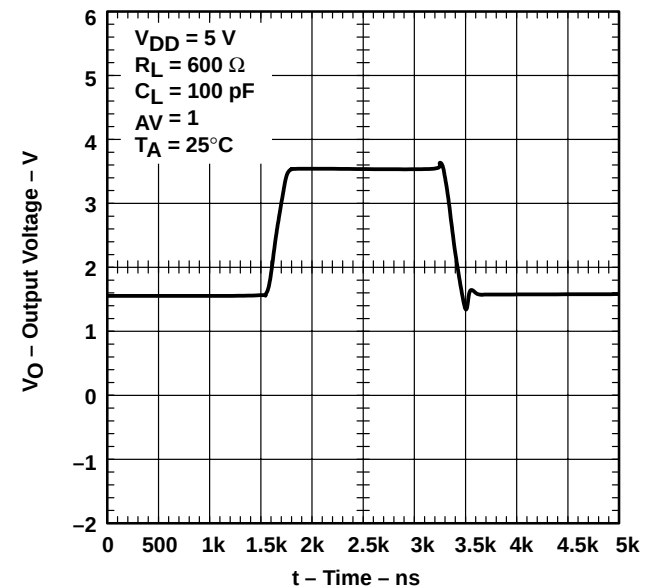


Figure 34

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INVERTING SMALL-SIGNAL
PULSE RESPONSE

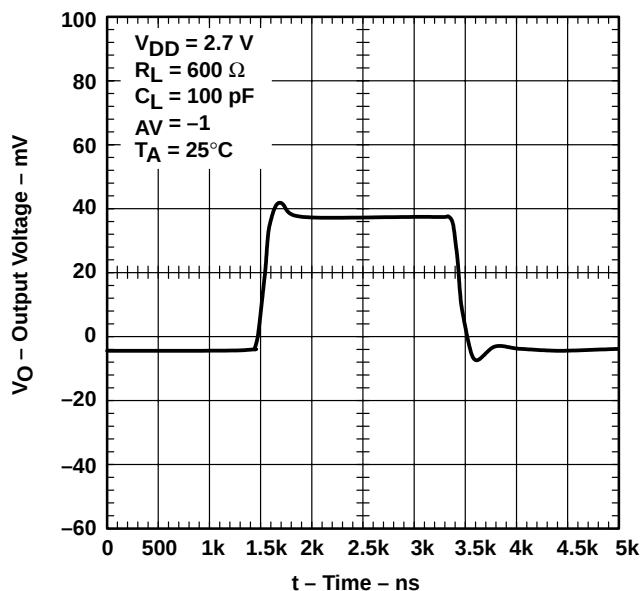


Figure 35

INVERTING SMALL-SIGNAL
PULSE RESPONSE

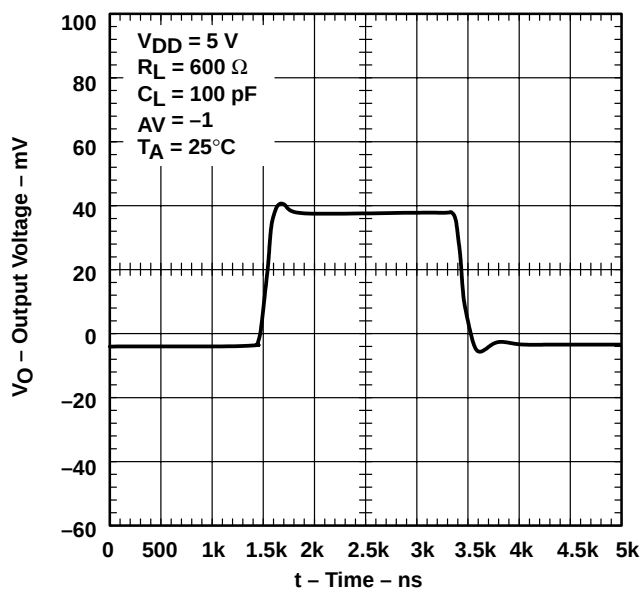


Figure 36

INVERTING LARGE-SIGNAL
PULSE RESPONSE

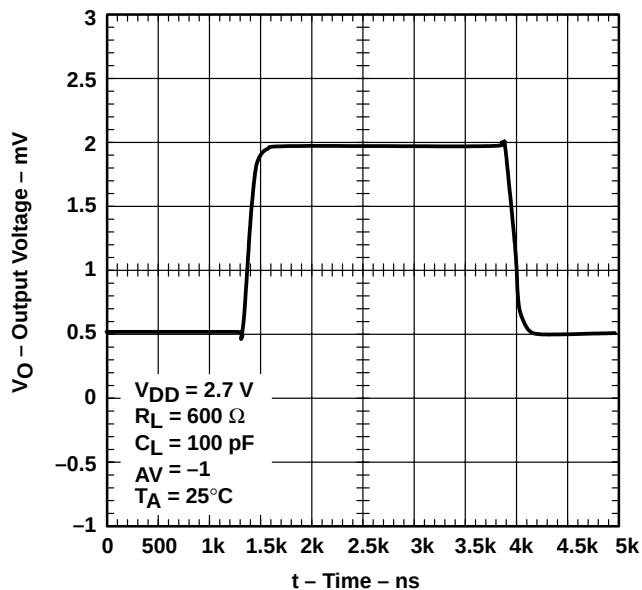


Figure 37

INVERTING LARGE-SIGNAL
PULSE RESPONSE

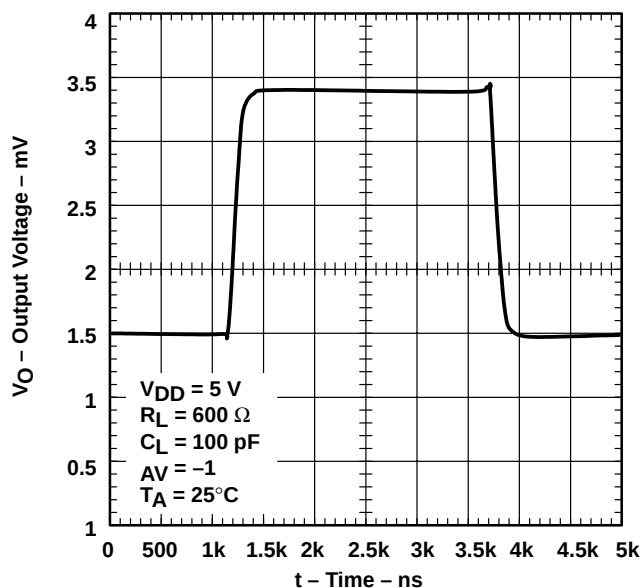


Figure 38

TYPICAL CHARACTERISTICS

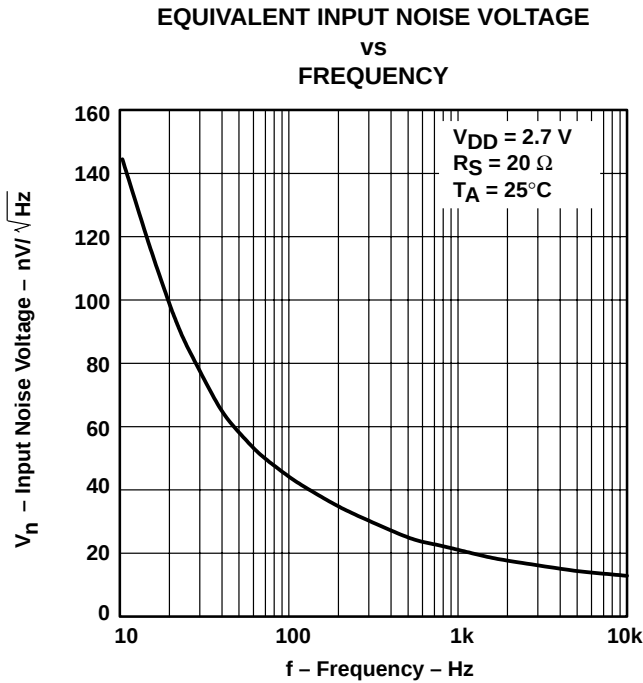


Figure 39

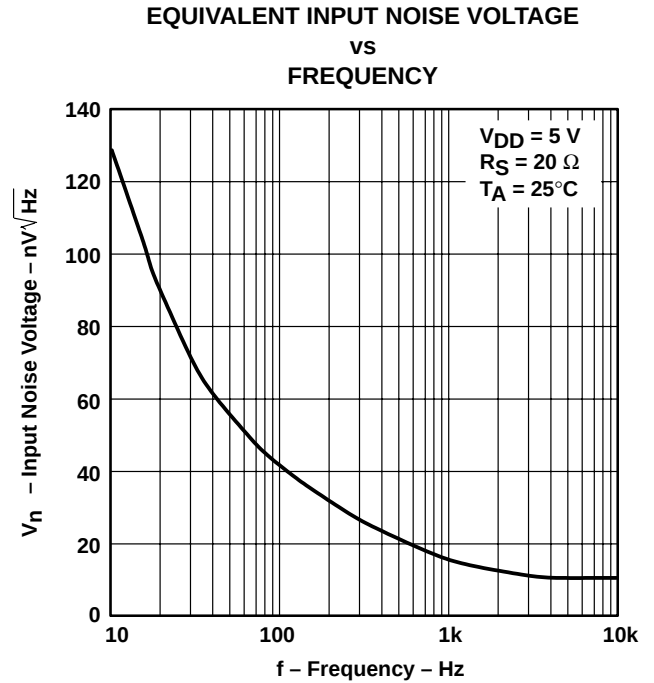


Figure 40

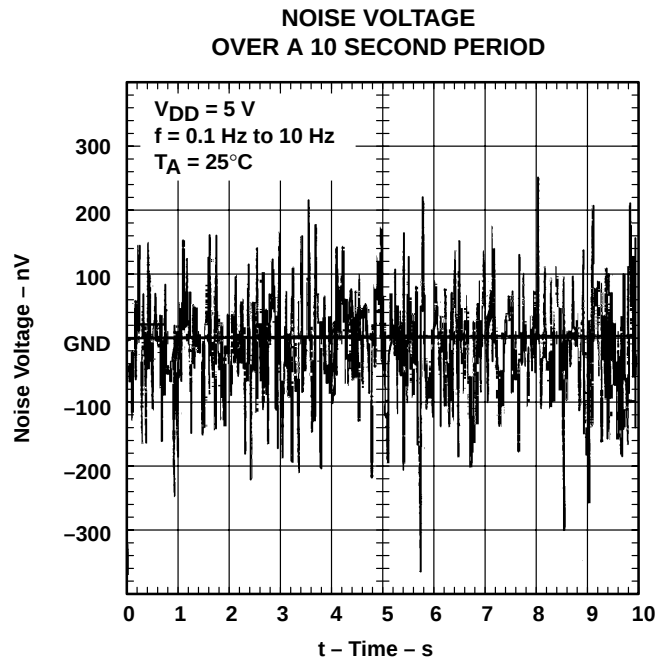


Figure 41

TLV2772, TLV2772A, TLV2772Y

2.7-V HIGH-SLEW-RATE RAIL-TO-RAIL OUTPUT

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TYPICAL CHARACTERISTICS

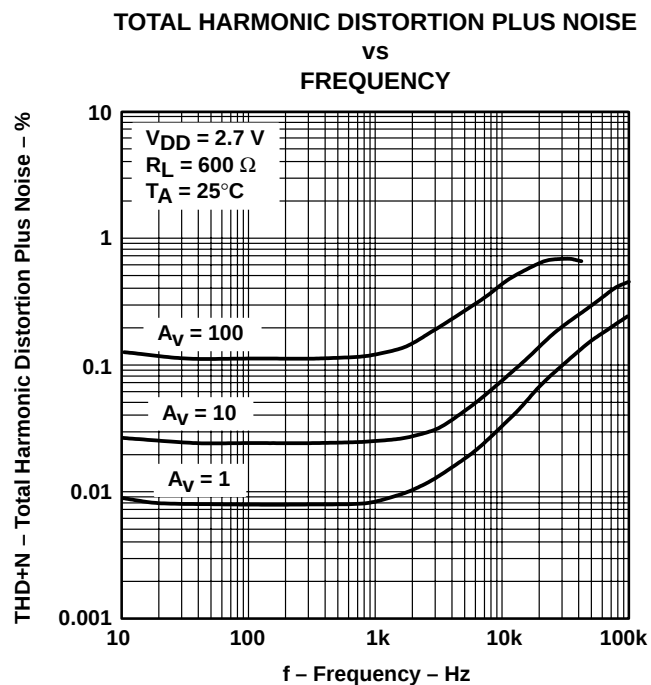


Figure 42

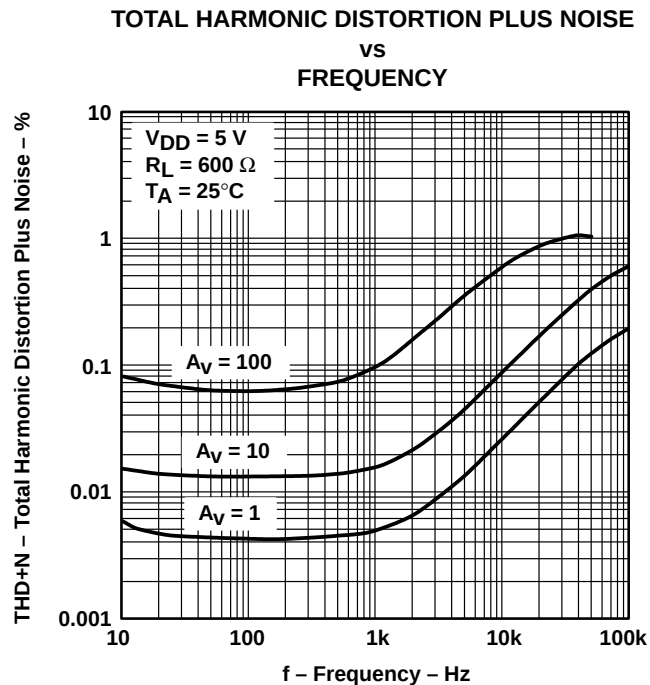


Figure 43

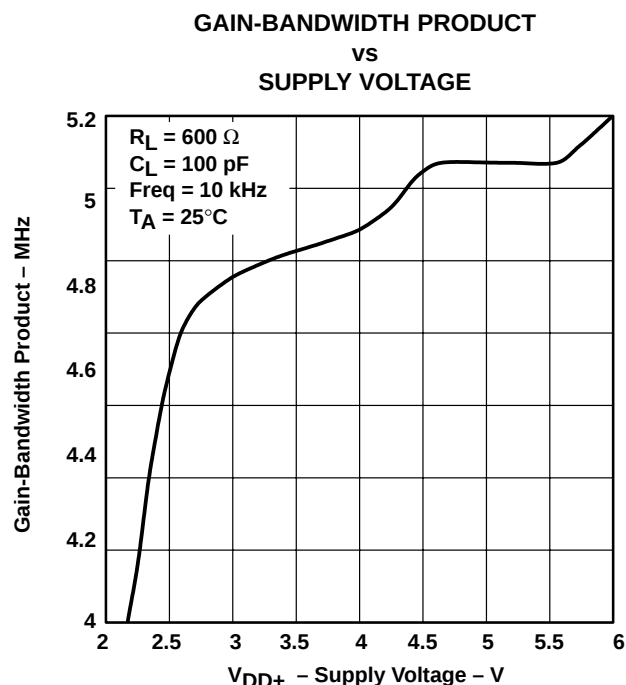


Figure 44

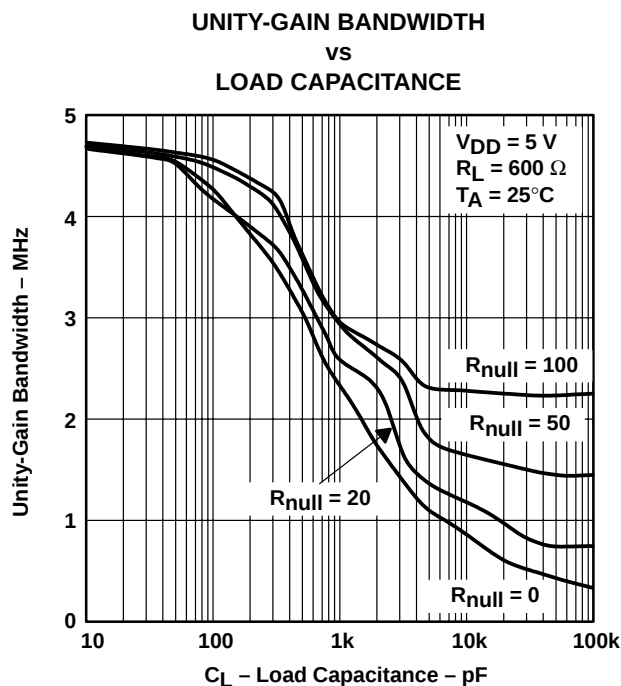


Figure 45

TYPICAL CHARACTERISTICS

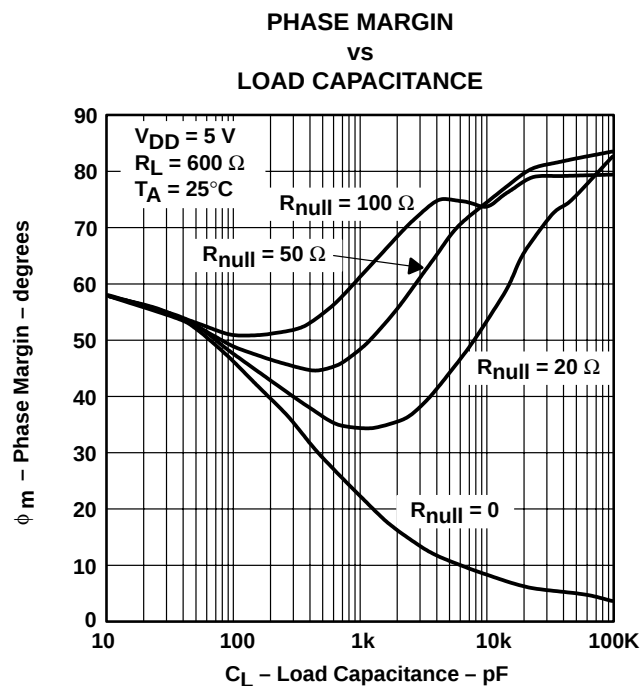


Figure 46

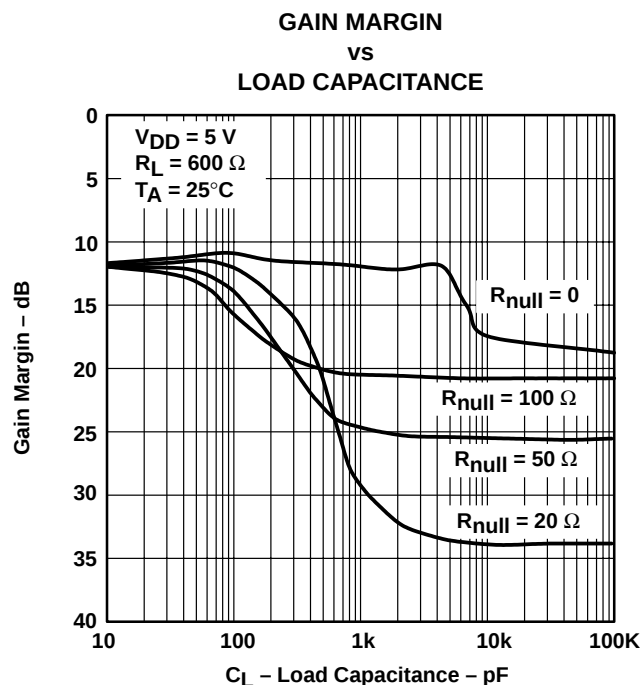


Figure 47

TLV2772, TLV2772A, TLV2772Y

2.7-V HIGH-SLEW-RATE RAIL-TO-RAIL OUTPUT

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APPLICATION INFORMATION

macromodel information

Macromodel information provided was derived using Microsim *Parts*™ Release 8, the model generation software used with Microsim *PSpice*™. The Boyle macromodel (see Note 4) and subcircuit in Figure 48 are generated using the TLV2772 typical electrical and operating characteristics at $T_A = 25^\circ\text{C}$. Using this information, output simulations of the following key parameters can be generated to a tolerance of 20% (in most cases):

- Maximum positive output voltage swing
- Maximum negative output voltage swing
- Slew rate
- Quiescent power dissipation
- Input bias current
- Open-loop voltage amplification
- Unity-gain frequency
- Common-mode rejection ratio
- Phase margin
- DC output resistance
- AC output resistance
- Short-circuit output current limit

NOTE 4: G. R. Boyle, B. M. Cohn, D. O. Pederson, and J. E. Solomon, "Macromodeling of Intergrated Circuit Operational Amplifiers", *IEEE Journal of Solid-State Circuits*, SC-9, 353 (1974).

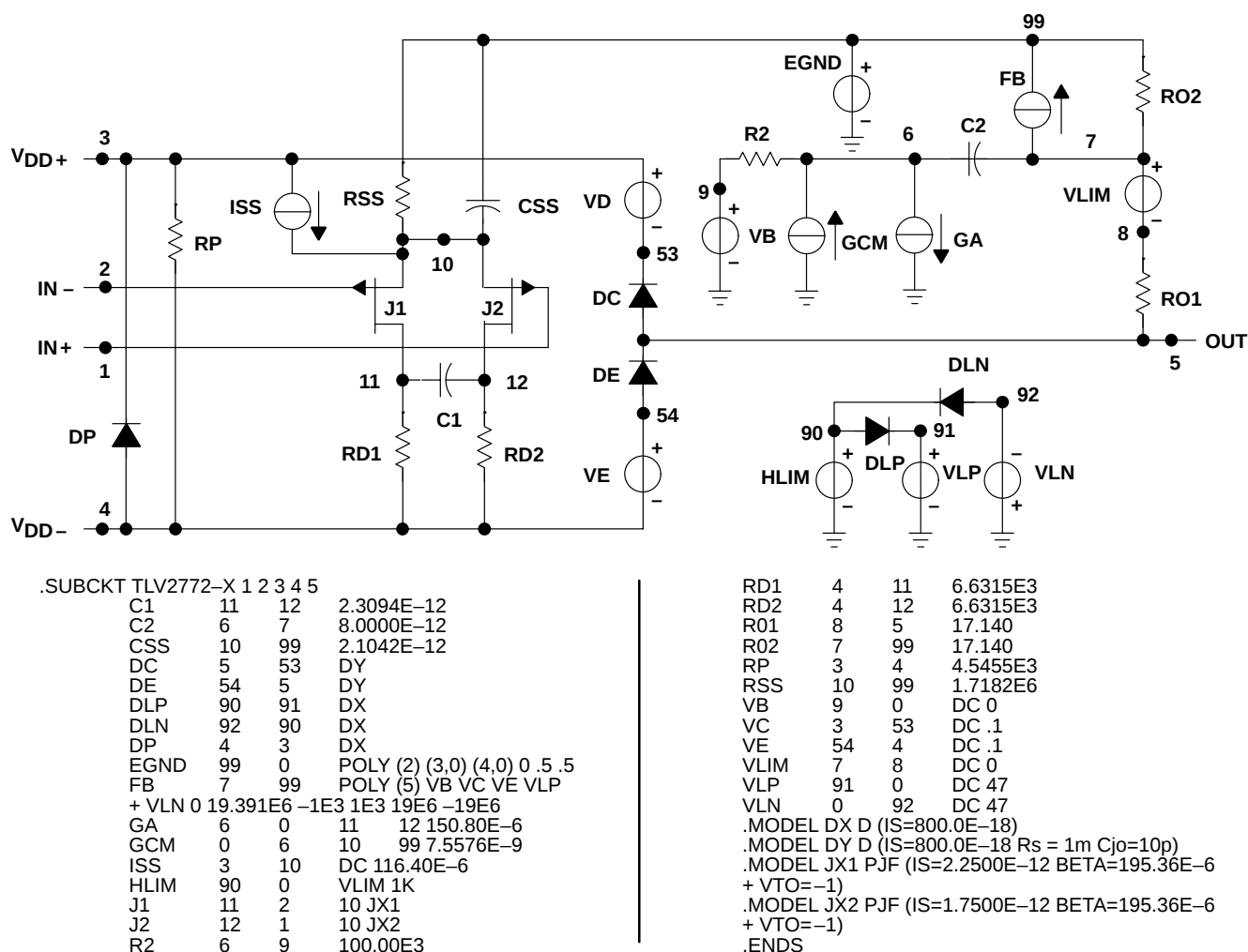


Figure 48. Boyle Macromodel and Subcircuit

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TLV2772, TLV2772A, TLV2772Y
2.7-V HIGH-SLEW-RATE RAIL-TO-RAIL OUTPUT
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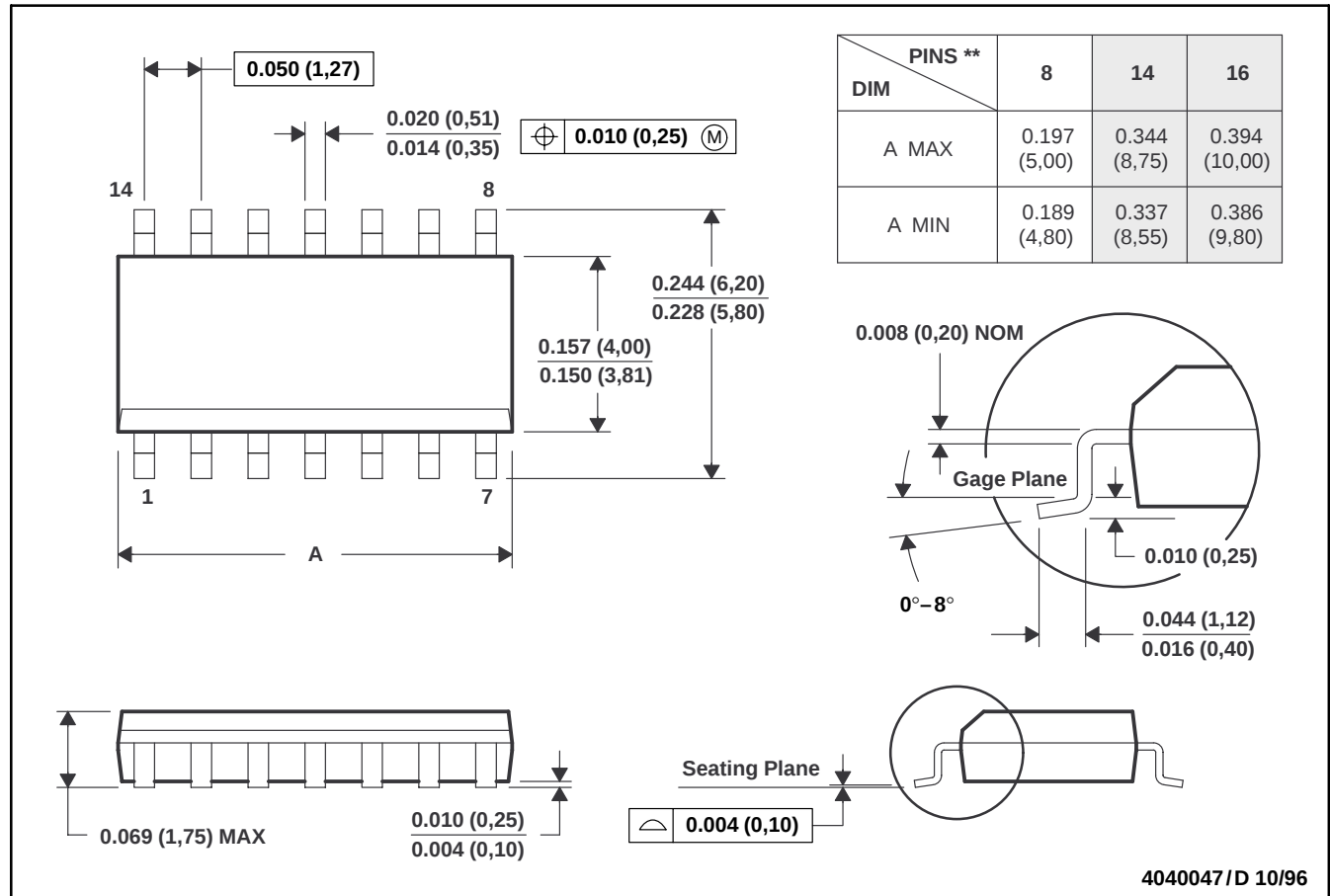
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MECHANICAL INFORMATION

D (R-PDSO-G)**

PLASTIC SMALL-OUTLINE PACKAGE

14 PIN SHOWN



- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).
 - Falls within JEDEC MS-012

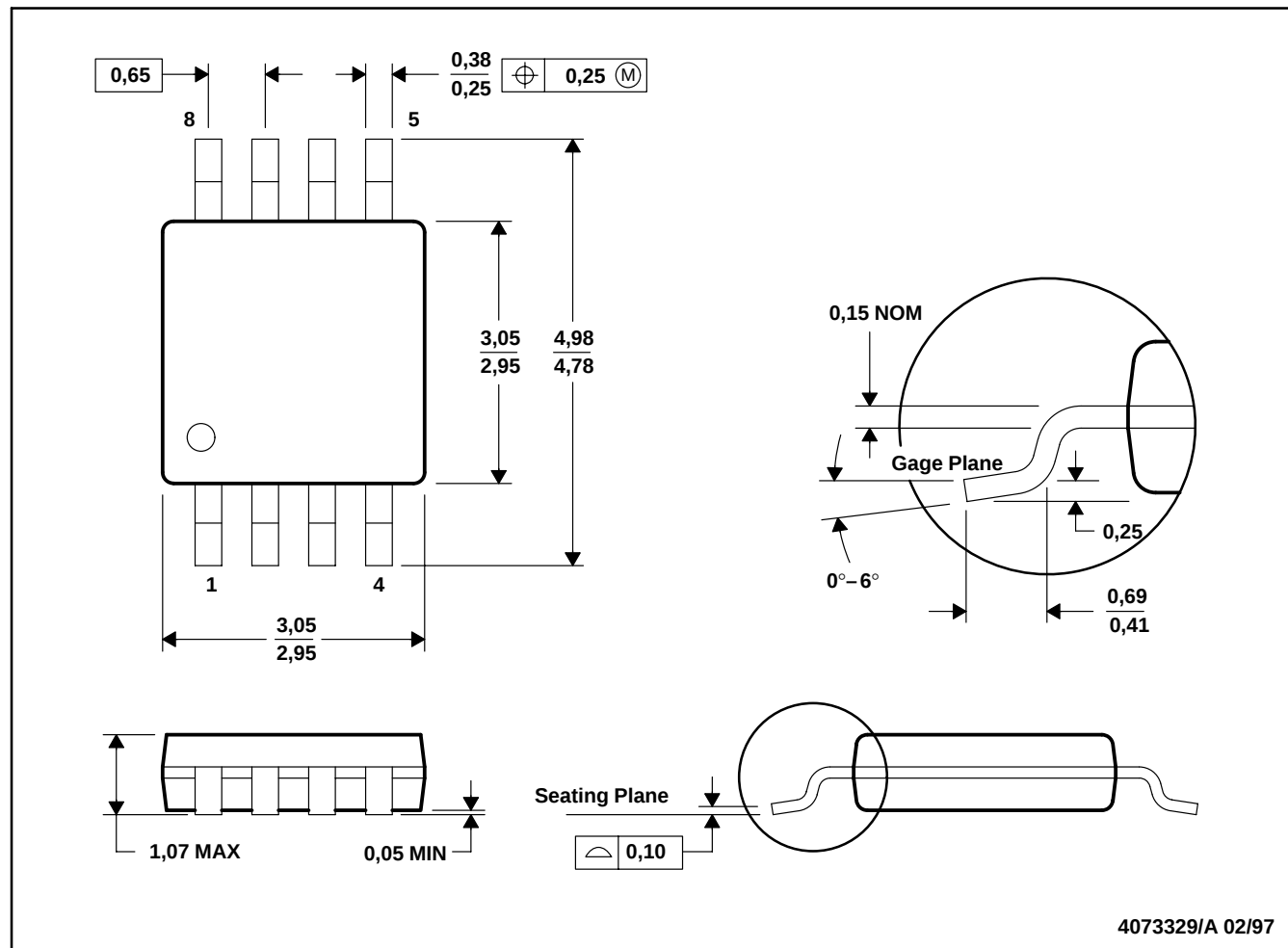
TLV2772, TLV2772A, TLV2772Y
2.7-V HIGH-SLEW-RATE RAIL-TO-RAIL OUTPUT
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MECHANICAL INFORMATION

DGK (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion.

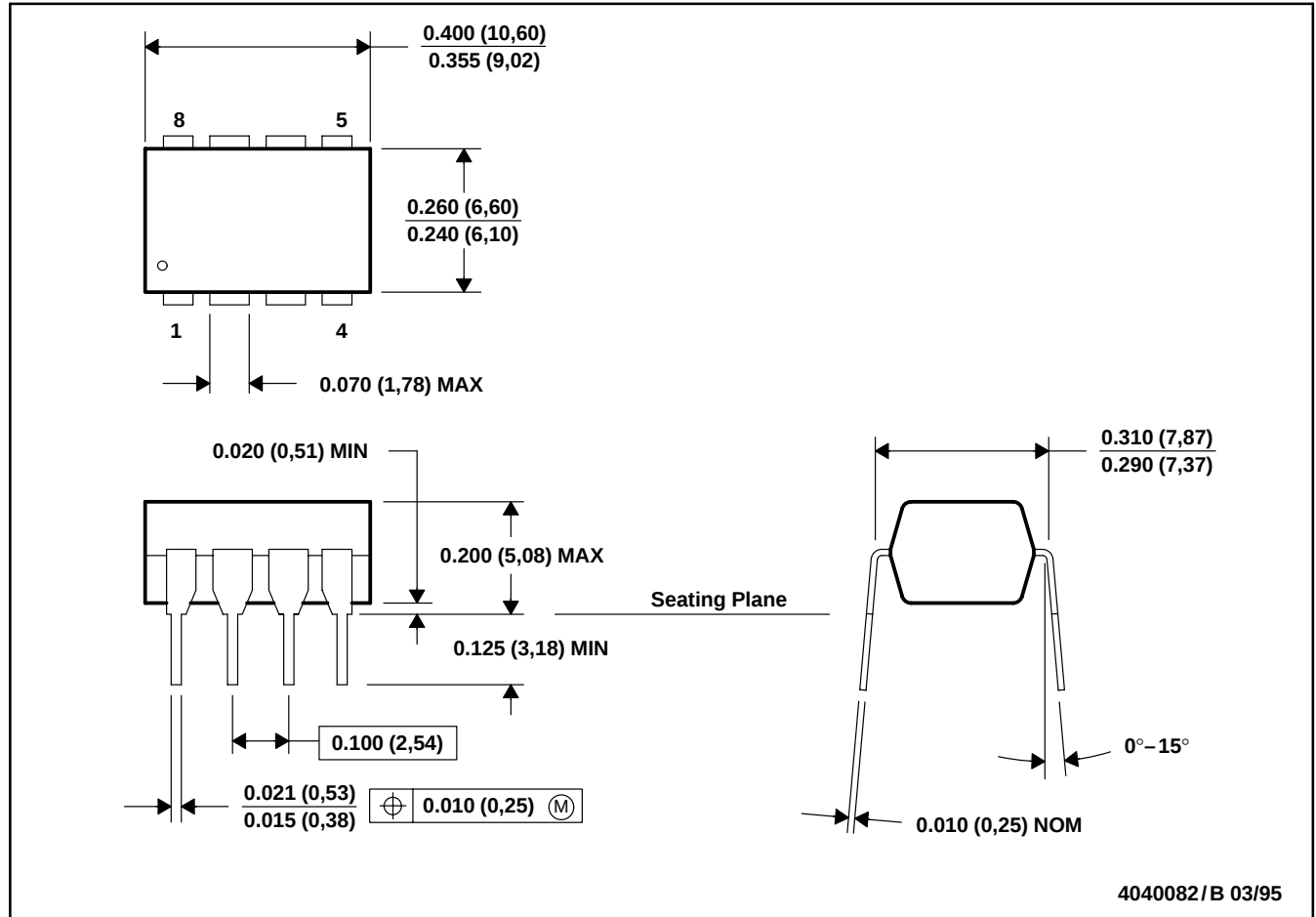
TLV2772, TLV2772A, TLV2772Y
2.7-V HIGH-SLEW-RATE RAIL-TO-RAIL OUTPUT
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MECHANICAL INFORMATION

P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE PACKAGE



- NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-001

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