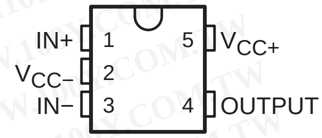
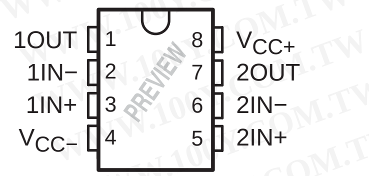
LMV931 SINGLE, LMV932 DUAL, LMV934 QUAD 1.8-V OPERATIONAL AMPLIFIERS WITH RAIL-TO-RAIL INPUT AND OUTPUT

- 1.8-V, 2.7-V, and 5-V Specifications
- Rail-to-Rail Output Swing
  - 600-Ω Load . . . 80 mV From Rail
  - 2-kΩ Load . . . 30 mV From Rail
- V_{ICR} . . . 200 mV Beyond Rails
- Gain Bandwidth . . . 1.4 MHz
- Supply Current . . . 100 µA/Amplifier
- Max V_{IO} . . . 4 mV
- Space-Saving Packages
  - LMV931: SOT-23 and SC-70
  - LMV932: MSOP and SOIC
  - LMV934: SOIC and TSSOP
- Applications
  - Industrial (Utility/Energy Metering)
  - Automotive
  - Communications (Optical Telecom, Data/Voice Cable Modems)
  - Consumer Electronics (PDAs, PCs, CDR/W, Portable Audio)
  - Supply-Current Monitoring
  - Battery Monitoring

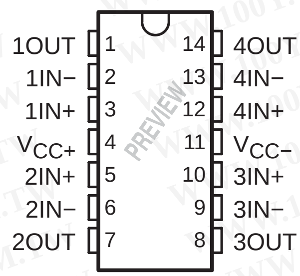
LMV931 . . . DBV (SOT23-5) OR DCK (SC-70) PACKAGE (TOP VIEW)



LMV932 . . . D (SOIC) OR DGK (VSSOP/MSOP) PACKAGE (TOP VIEW)



LMV934 . . . D (SOIC) OR PW (TSSOP) PACKAGE (TOP VIEW)



description/ordering information

ORDERING INFORMATION

T_A	PACKAGE†			ORDERABLE PART NUMBER	TOP-SIDE MARKING‡
−40°C to 125°C	Single	SOT-23 (DBV)	Reel of 3000	LMV931IDBVR	RBB_
			Reel of 250	LMV931IDBVT	PREVIEW
		SC-70 (DCK)	Reel of 3000	LMV931IDCKR	RB_
			Reel of 250	LMV931IDCKT	PREVIEW
	Dual	MSOP/VSSOP (DGK)	Reel of 2500	LMV932IDGKR	PREVIEW
			Reel of 250	LMV932IDGKT	
		SOIC (D)	Tube of 75	LMV932ID	PREVIEW
			Reel of 2500	LMV932IDR	
	Quad	SOIC (D)	Tube of 50	LMV934ID	PREVIEW
			Reel of 2500	LMV934IDR	
		TSSOP (PW)	Tube of 90	LMV934IPW	PREVIEW
			Reel of 2000	LMV934IPWR	

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.
‡ DBV/DCK/DGK: The actual top-side marking has one additional character that designates the assembly/test site.

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.

description/ordering information (continued)

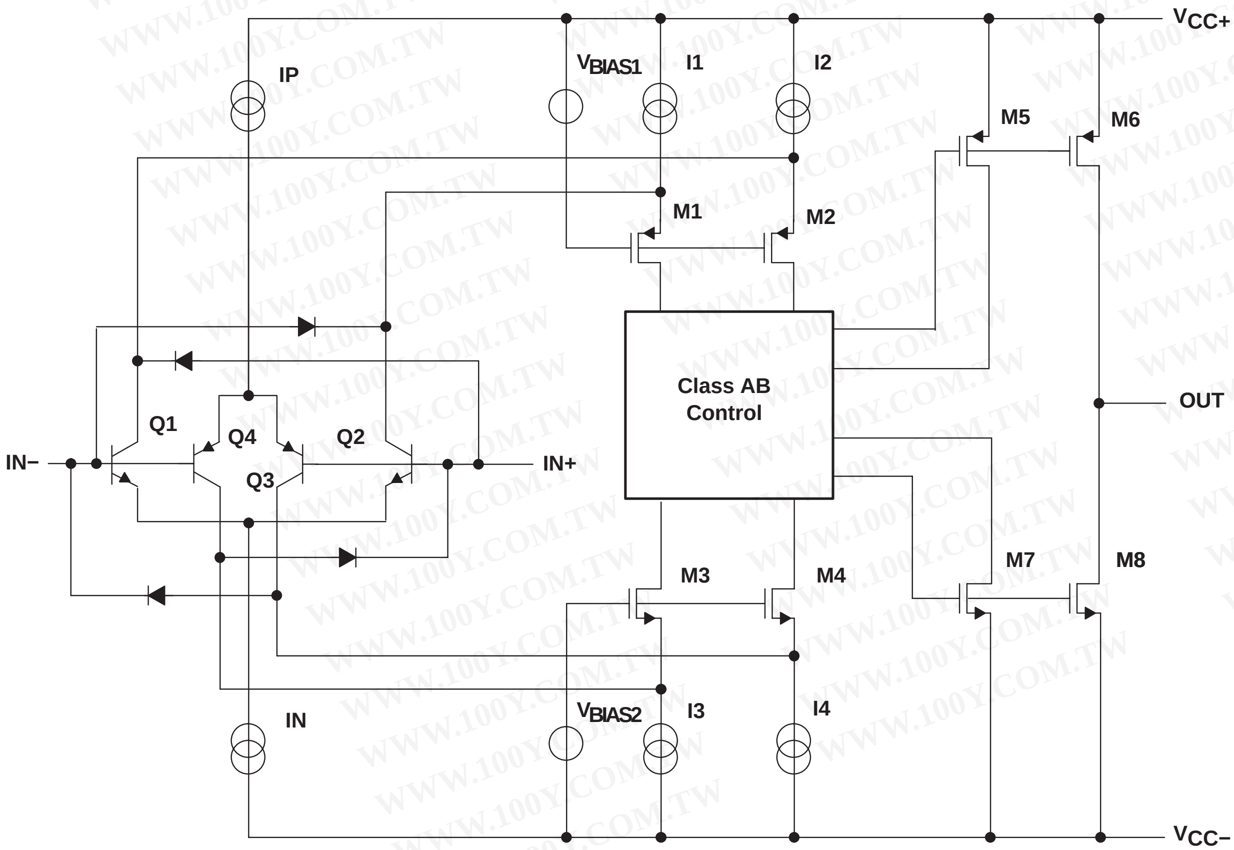
The LMV93x devices are low-voltage, low-power, operational amplifiers that are well suited for today's low-voltage and/or portable applications. Specified for operation of 1.8 V to 5 V, they can be used in portable applications that are powered from a single-cell Li-ion or two-cell batteries. They have rail-to-rail input and output capability for maximum signal swings in low-voltage applications. The LMV93x input common-mode voltage extends 200 mV beyond the rails for increased flexibility. The output can swing rail-to-rail unloaded and typically can reach 80 mV from the rails, while driving a 600-Ω load (at 1.8-V operation).

During 1.8-V operation, the devices typically consume a quiescent current of 103 μA per channel, and yet they are able to achieve excellent electrical specifications, such as 101-dB open-loop DC gain and 1.4-MHz gain bandwidth. Furthermore, the amplifiers offer good output drive characteristics, with the ability to drive a 600-Ω load and 1000-pF capacitance with minimal ringing.

The LMV93x devices are offered in the latest packaging technology to meet the most demanding space-constraint applications. The LMV931 is offered in standard SOT-23 and SC-70 packages. The LMV932 is available in the traditional MSOP and SOIC packages. The LMV934 is available in the traditional SOIC and TSSOP packages.

The LMV93x devices are characterized for operation from −40°C to 125°C, making the part universally suited for commercial, industrial, and automotive applications.

simplified schematic



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

Supply voltage, $V_{CC+} - V_{CC-}$ (see Note 1)		5.5 V
Differential input voltage, V_{ID} (see Note 2)		Supply voltage
Input voltage range, V_I (either input)		V_{CC-} − 0.2 V to V_{CC+} + 0.2 V
Duration of output short circuit (one amplifier) to $V_{CC}\pm$ (see Notes 3 and 4)		Unlimited
Package thermal impedance, θ_{JA} (see Notes 4 and 5):	D package (8 pin)	97°C/W
	D package (14 pin)	86°C/W
	DBV package	206°C/W
	DCK package	252°C/W
	DGK package	172°C/W
	PW package	113°C/W
Operating virtual junction temperature, T_J		150°C
Storage temperature range, T_{stg}		−65 to 150°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 and V_{CC} specified for the measurement of I_{OS}) are with respect to the network GND.
2. Differential voltages are at IN+ with respect to IN−.
3. Applies to both single-supply and split-supply operation. Continuous short-circuit operation at elevated ambient temperature can result in exceeding the maximum allowed junction temperature of 150°C. Output currents in excess of 45 mA over long term may adversely affect reliability.
4. Maximum power dissipation is a function of T_J(max), θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
5. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions

		MIN	MAX	UNIT
V_{CC}	Supply voltage ($V_{CC+} - V_{CC-}$)	1.8	5	V
T_A	Operating free-air temperature	−40	125	°C

ESD protection

TEST CONDITIONS	TYP	UNIT
Human-Body Model	2000	V
Machine Model	200	V

electrical characteristics at T_A = 25°C, V_{CC+} = 1.8 V, V_{CC-} = 0 V, V_{IC} = V_{CC+}/2, V_O = V_{CC+}/2, and R_L > 1 MΩ (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	LMV931 (single)	25°C		1	4	mV
			Full range			6	
		LMV932 (dual), LMV934 (quad)	25°C		1	5.5	
			Full range			7.5	
α_{VIO}	Average temperature coefficient of input offset voltage		25°C		5.5		µV/°C
I_{IB}	Input bias current	V_{IC} = V_{CC+} − 0.8 V	25°C		15	35	nA
			25°C			65	
			Full range			75	
I_{IO}	Input offset current		25°C		13	25	nA
			Full range			40	
I_{CC}	Supply current (per channel)		25°C		103	185	µA
			Full range			205	
CMRR	Common-mode rejection ratio	0 ≤ V_{IC} ≤ 0.6 V, 1.4 V ≤ V_{IC} ≤ 1.8 V	25°C	60	78		dB
			−40°C to 85°C	55			
		0.2 V ≤ V_{IC} ≤ 0.6 V, 1.4 V ≤ V_{IC} ≤ 1.6 V	−40°C to 125°C	55			
		−0.2 V ≤ V_{IC} ≤ 0 V, 1.8 V ≤ V_{IC} ≤ 2 V	25°C	50	72		
k_{SVR}	Supply-voltage rejection ratio	1.8 V ≤ V_{CC+} ≤ 5 V, V_{IC} = 0.5 V	25°C	75	100		dB
			Full range	70			
V_{ICR}	Common-mode input voltage range	CMRR ≥ 50 dB	25°C	V_{CC-} − 0.2	−0.2 to 2.1	V_{CC+} + 0.2	V
			−40°C to 85°C	V_{CC-}		V_{CC+}	
			−40°C to 125°C	V_{CC-} + 0.2		V_{CC+} − 0.2	
A_V	Large-signal voltage gain	LMV931: R_L = 600 Ω to 0.9 V, V_O = 0.2 V to 1.6 V, V_{IC} = 0.5 V	25°C	77	101		dB
			Full range	73			
		LMV931: R_L = 2 kΩ to 0.9 V, V_O = 0.2 V to 1.6 V, V_{IC} = 0.5 V	25°C	80	105		
			Full range	75			
		LMV932, LMV934: R_L = 600 Ω to 0.9 V, V_O = 0.2 V to 1.6 V, V_{IC} = 0.5 V	25°C	75	90		
			Full range	72			
		LMV932, LMV934: R_L = 2 kΩ to 0.9 V, V_O = 0.2 V to 1.6 V, V_{IC} = 0.5 V	25°C	78	100		
			Full range	75			

electrical characteristics at T_A = 25°C, V_{CC+} = 1.8 V, V_{CC-} = 0 V, V_{IC} = V_{CC+}/2, V_O = V_{CC+}/2, and R_L > 1 MΩ (unless otherwise noted)(continued)

PARAMETER		TEST CONDITIONS		T_A	MIN	TYP	MAX	UNIT
V_O	Output swing	R_L = 600 Ω to 0.9 V, V_{ID} = ±100 mV	High level	25°C	1.65	1.72		V
				Full range	1.63			
			Low level	25°C		0.077	0.105	
				Full range			0.120	
		R_L = 2 kΩ to 0.9 V, V_{ID} = ±100 mV	High level	25°C	1.75	1.77		
				Full range	1.74			
			Low level	25°C		0.024	0.035	
				Full range			0.04	
I_{OS}	Output short-circuit current	V_O = 0 V, V_{ID} = 100 mV	Sourcing	25°C	4	8		mA
				Full range	3.3			
		V_O = 1.8 V, V_{ID} = −100 mV	Sinking	25°C	7	9		
				Full range	5			
GBW	Gain bandwidth product			25°C		1.4		MHz
SR	Slew rate	See Note 6		25°C		0.35		V/μS
Φ_m	Phase margin			25°C		67		°
	Gain margin			25°C		7		dB
V_n	Equivalent input noise voltage	f = 1 kHz, V_{IC} = 0.5 V		25°C		60		nV/√Hz
I_n	Equivalent input noise current	f = 1 kHz		25°C		0.06		pA/√Hz
THD	Total harmonic distortion	f = 1 kHz, A_V = 1, R_L = 600 Ω, V_{ID} = 1 V_{p-p}		25°C		0.023		%
	Amp-to-amp isolation	See Note 7		25°C		123		dB

NOTES: 6. Number specified is the slower of the positive and negative slew rates.
7. Input referred, V_{CC+} = 5 V and R_L = 100 kΩ connected to 2.5 V. Each amp is excited, in turn, with a 1-kHz signal to produce V_O = 3 V_{p-p}.

electrical characteristics at T_A = 25°C, V_{CC+} = 2.7 V, V_{CC-} = 0 V, V_{IC} = $V_{CC+}/2$, V_O = $V_{CC+}/2$, and R_L > 1 MΩ (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	LMV931 (single)	25°C		1	4	mV
			Full range			6	
		LMV932 (dual), LMV934 (quad)	25°C		1	5.5	
			Full range			7.5	
α_{VIO}	Average temperature coefficient of input offset voltage		25°C		5.5		μV/°C
I_{IB}	Input bias current	$V_{IC} = V_{CC+} - 0.8$ V	25°C		15	35	nA
			25°C			65	
			Full range			75	
I_{IO}	Input offset current		25°C		8	25	nA
			Full range			40	
I_{CC}	Supply current (per channel)		25°C		105	190	μA
			Full range			210	
CMRR	Common-mode rejection ratio	0 ≤ V_{IC} ≤ 1.5 V, 2.3 V ≤ V_{IC} ≤ 2.7 V	25°C	60	81		dB
			−40°C to 85°C	55			
		0.2 ≤ V_{IC} ≤ 1.5 V, 2.3 V ≤ V_{IC} ≤ 2.5 V	−40°C to 125°C	55			
		−0.2 V ≤ V_{IC} ≤ 0 V, 2.7 V ≤ V_{IC} ≤ 2.9 V	25°C	50	74		
k_{SVR}	Supply-voltage rejection ratio	1.8 V ≤ V_{CC+} ≤ 5 V, V_{IC} = 0.5 V	25°C	75	100		dB
			Full range	70			
V_{ICR}	Common-mode input voltage range	CMRR ≥ 50 dB	25°C	$V_{CC-} - 0.2$	−0.2 to 3.0	$V_{CC+} + 0.2$	V
			−40°C to 85°C	V_{CC-}		V_{CC+}	
			−40°C to 125°C	$V_{CC-} + 0.2$		$V_{CC+} - 0.2$	
A_V	Large-signal voltage gain, LMV931	R_L = 600 Ω to 1.35 V, V_O = 0.2 V to 2.5 V	25°C	87	104		dB
			Full range	86			
		R_L = 2 kΩ to 1.35 V, V_O = 0.2 V to 2.5 V	25°C	92	110		
			Full range	91			
	Large-signal voltage gain, LMV932, LMV934	R_L = 600 Ω to 1.35 V, V_O = 0.2 V to 2.5 V	25°C	78	90		
			Full range	75			
		R_L = 2 kΩ to 1.35 V, V_O = 0.2 V to 2.5 V	25°C	81	100		
			Full range	78			

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electrical characteristics at T_A = 25°C, V_{CC+} = 2.7 V, V_{CC-} = 0 V, V_{IC} = V_{CC+}/2, V_O = V_{CC+}/2, and R_L > 1 MΩ (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A	MIN	TYP	MAX	UNIT
V_O	Output swing	R_L = 600 Ω to 1.35 V, V_{ID} = ±100 mV	High level	25°C	2.55	2.62		V
				Full range	2.53			
			Low level	25°C		0.083	0.11	
				Full range			0.13	
		R_L = 2 kΩ to 1.35 V, V_{ID} = ±100 mV	High level	25°C	2.65	2.675		
				Full range	2.64			
			Low level	25°C		0.025	0.04	
				Full range			0.045	
I_{OS}	Output short-circuit current	V_O = 0 V, V_{ID} = 100 mV	Sourcing	25°C	20	30		mA
				Full range	15			
		V_O = 2.7 V, V_{ID} = −100 mV	Sinking	25°C	18	25		
				Full range	12			
GBW	Gain bandwidth product			25°C		1.4		MHz
SR	Slew rate	See Note 6		25°C		0.4		V/μS
Φ_m	Phase margin			25°C		70		°
	Gain margin			25°C		7.5		dB
V_n	Equivalent input noise voltage	f = 1 kHz, V_{IC} = 0.5 V		25°C		57		$nV/\sqrt{Hz}$
I_n	Equivalent input noise current	f = 1 kHz		25°C		0.082		$pA/\sqrt{Hz}$
THD	Total harmonic distortion	f = 1 kHz, A_V = 1, R_L = 600 Ω, V_{ID} = 1 V_{p-p}		25°C		0.022		%
	Amp-to-amp isolation	See Note 7		25°C		123		dB

NOTES: 6. Number specified is the slower of the positive and negative slew rates.
7. Input referred, V_{CC+} = 5 V and R_L = 100 kΩ connected to 2.5 V. Each amp is excited, in turn, with a 1-kHz signal to produce V_O = 3 V_{p-p}.

electrical characteristics at T_A = 25°C, V_{CC+} = 5 V, V_{CC-} = 0 V, V_{IC} = V_{CC+}/2, V_O = V_{CC+}/2, and R_L > 1 MΩ (unless otherwise noted)

PARAMETER			TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage		LMV931 (single)	25°C		1	4	mV
				Full range			6	
			LMV932 (dual), LMV934 (quad)	25°C		1	5.5	
				Full range			7.5	
α_{VIO}	Average temperature coefficient of input offset voltage			25°C		5.5		µV/°C
I_{IB}	Input bias current		$V_{IC} = V_{CC+} - 0.8$ V	25°C		15	35	nA
				25°C			65	
				Full range			75	
I_{IO}	Input offset current			25°C		9	25	nA
				Full range			40	
I_{CC}	Supply current (per channel)			25°C		116	210	µA
				Full range			230	
CMRR	Common-mode rejection ratio		$0 \le V_{IC} \le 3.8$ V, $4.6\ V \le V_{IC} \le 5$ V	25°C	60	86		dB
				−40°C to 85°C	55			
			$0.3 \le V_{IC} \le 3.8$ V, $4.6\ V \le V_{IC} \le 4.7$ V	−40°C to 125°C	55			
			$-0.2\ V \le V_{IC} \le 0$ V, $5\ V \le V_{IC} \le 5.2$ V	25°C	50	78		
k_{SVR}	Supply-voltage rejection ratio		$1.8\ V \le V_{CC+} \le 5$ V, $V_{IC} = 0.5$ V	25°C	75	100		dB
				Full range	70			
V_{ICR}	Common-mode input voltage range		CMRR ≥ 50 dB	25°C	$V_{CC-} - 0.2$	−0.2 to 5.3	$V_{CC+} + 0.2$	V
				−40°C to 85°C	V_{CC-}		V_{CC+}	
				−40°C to 125°C	$V_{CC-} + 0.3$		$V_{CC+} - 0.3$	
A_V	Large-signal voltage gain	LMV931	R_L = 600 Ω to 2.5 V, V_O = 0.2 V to 4.8 V	25°C	88	102		dB
				Full range	87			
			R_L = 2 kΩ to 2.5 V, V_O = 0.2 V to 4.8 V	25°C	94	113		
				Full range	93			
		LMV932, LMV934	R_L = 600 Ω to 2.5 V, V_O = 0.2 V to 4.8 V	25°C	81	90		
				Full range	78			
			R_L = 2 kΩ to 2.5 V, V_O = 0.2 V to 4.8 V	25°C	85	100		
				Full range	82			

electrical characteristics at T_A= 25°C, V_{CC+} = 5 V, V_{CC-} = 0 V, V_{IC} = V_{CC+}/2, V_O = V_{CC+}/2, and R_L > 1 MΩ (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A	MIN	TYP	MAX	UNIT
V_O	Output swing	R_L = 600 Ω to 2.5 V, V_{ID} = ±100 mV	High level	25°C	4.855	4.89		V
				Full range	4.835			
			Low level	25°C		0.12	0.16	
				Full range			0.18	
		R_L = 2 kΩ to 2.5 V, V_{ID} = ±100 mV	High level	25°C	4.945	4.967		
				Full range	4.935			
			Low level	25°C		0.037	0.065	
				Full range			0.075	
I_{OS}	Output short-circuit current	V_O = 0 V, V_{ID} = 100 mV	Sourcing	25°C	80	100		mA
				Full range	68			
		V_O = 5 V, V_{ID} = −100 mV	Sinking	25°C	58	65		
				Full range	45			
GBW	Gain bandwidth product			25°C		1.5		MHz
SR	Slew rate	See Note 6		25°C		0.42		V/μS
Φ_m	Phase margin			25°C		71		°
	Gain margin			25°C		8		dB
V_n	Equivalent input noise voltage	f = 1 kHz, V_{IC} = 1 V		25°C		50		$nV/\sqrt{Hz}$
I_n	Equivalent input noise current	f = 1 kHz		25°C		0.07		$pA/\sqrt{Hz}$
THD	Total harmonic distortion	f = 1 kHz, A_V = 1, R_L = 600 Ω, V_{ID} = 1 V_{p-p}		25°C		0.022		%
	Amp-to-amp isolation	See Note 7		25°C		123		dB

NOTES: 6. Number specified is the slower of the positive and negative slew rates.
7. Input referred, V_{CC+} = 5 V and R_L = 100 kΩ connected to 2.5 V. Each amp is excited, in turn, with a 1-kHz signal to produce V_O = 3 V_{p-p}.

TYPICAL PERFORMANCE CHARACTERISTICS
Unless Otherwise Specified, V_{CC+} = 5 V, Single Supply, T_A = 25°C

SUPPLY CURRENT
vs
SUPPLY VOLTAGE

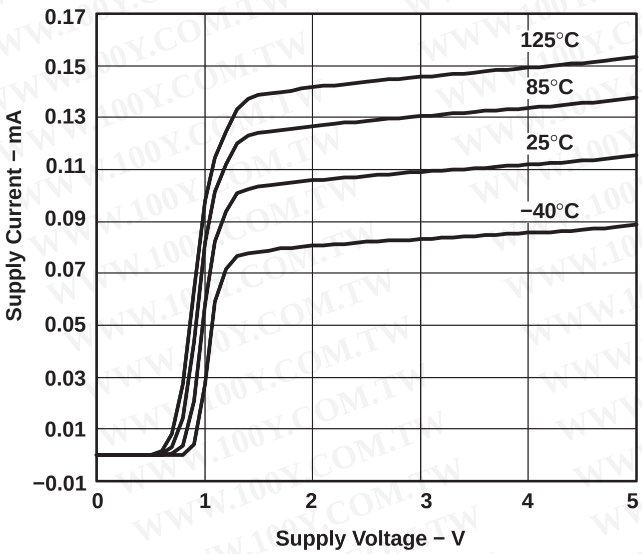

Figure 1

SLEW RATE
vs
SUPPLY VOLTAGE

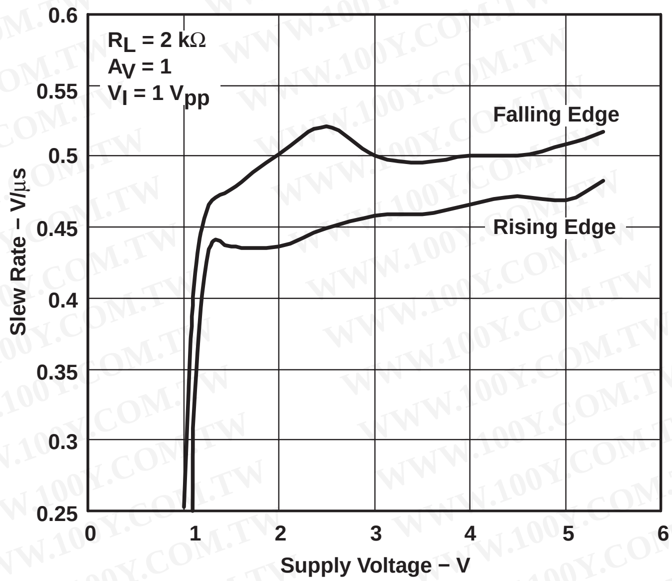

Figure 2

SOURCE CURRENT
vs
OUTPUT VOLTAGE

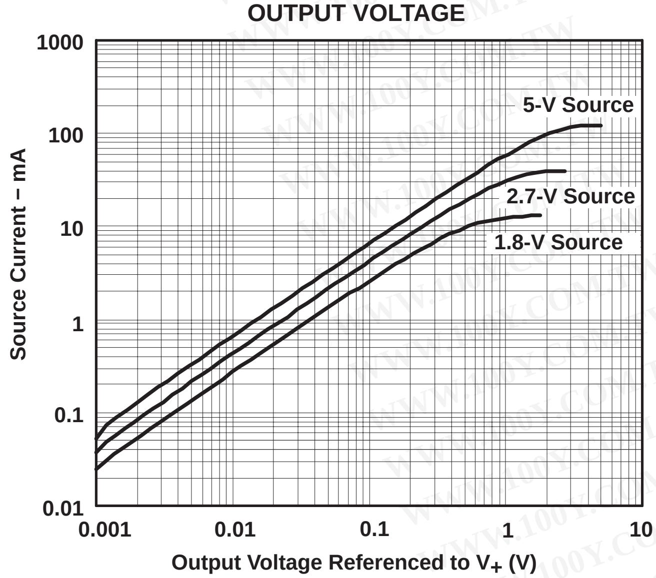

Figure 3

SINK CURRENT
vs
OUTPUT VOLTAGE

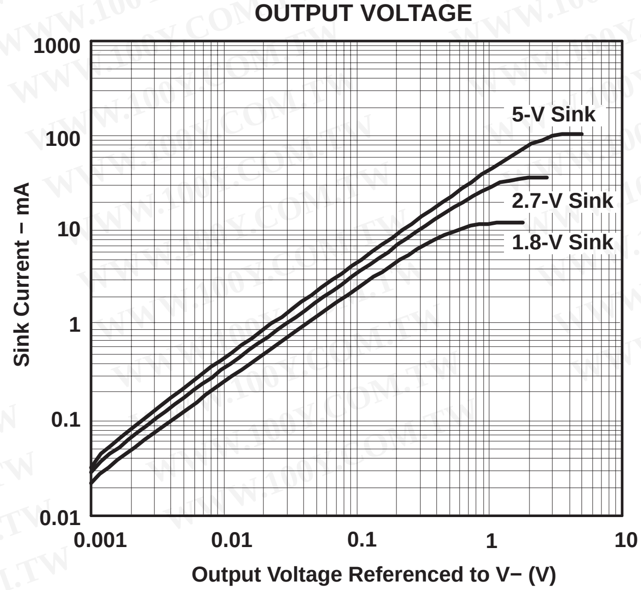

Figure 4

TYPICAL PERFORMANCE CHARACTERISTICS
Unless Otherwise Specified, V_{CC+} = 5 V, Single Supply, T_A = 25°C

OUTPUT VOLTAGE SWING
vs
SUPPLY VOLTAGE

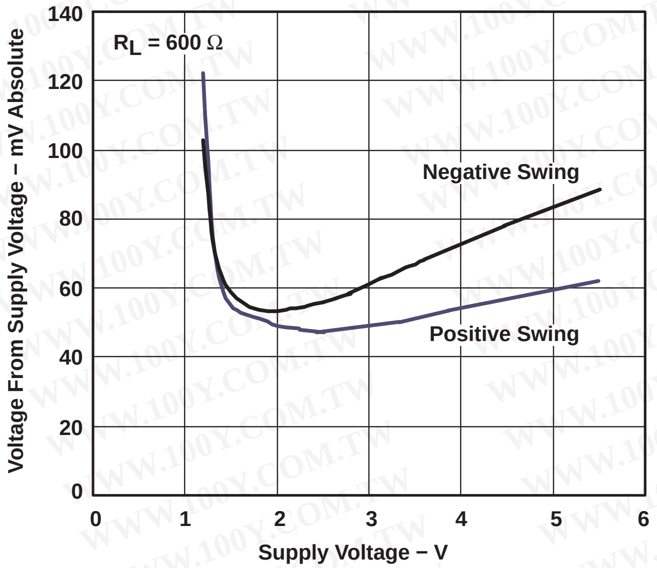

Figure 5

OUTPUT VOLTAGE SWING
vs
SUPPLY VOLTAGE

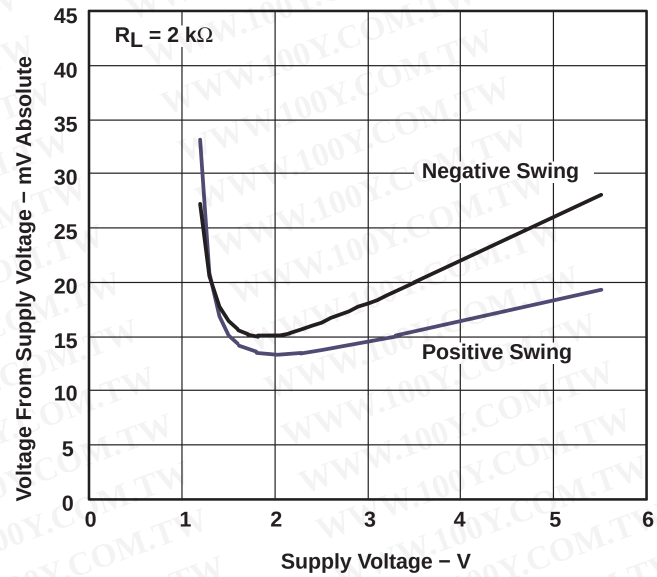

Figure 6

SHORT-CIRCUIT CURRENT (SINK)
vs
TEMPERATURE

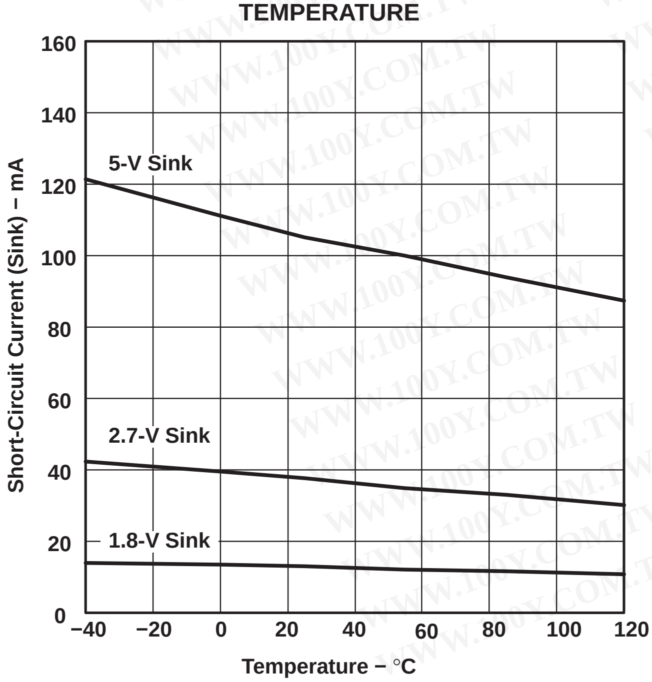

Figure 7

SHORT-CIRCUIT CURRENT (SOURCE)
vs
TEMPERATURE

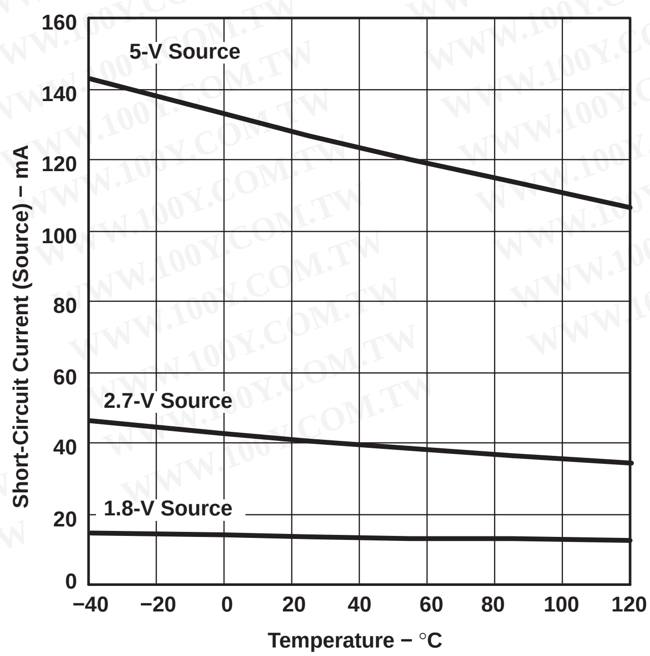

Figure 8

TYPICAL PERFORMANCE CHARACTERISTICS
Unless Otherwise Specified, V_{CC+} = 5 V, Single Supply, T_A = 25°C

1.8-V FREQUENCY RESPONSE
vs
C_L

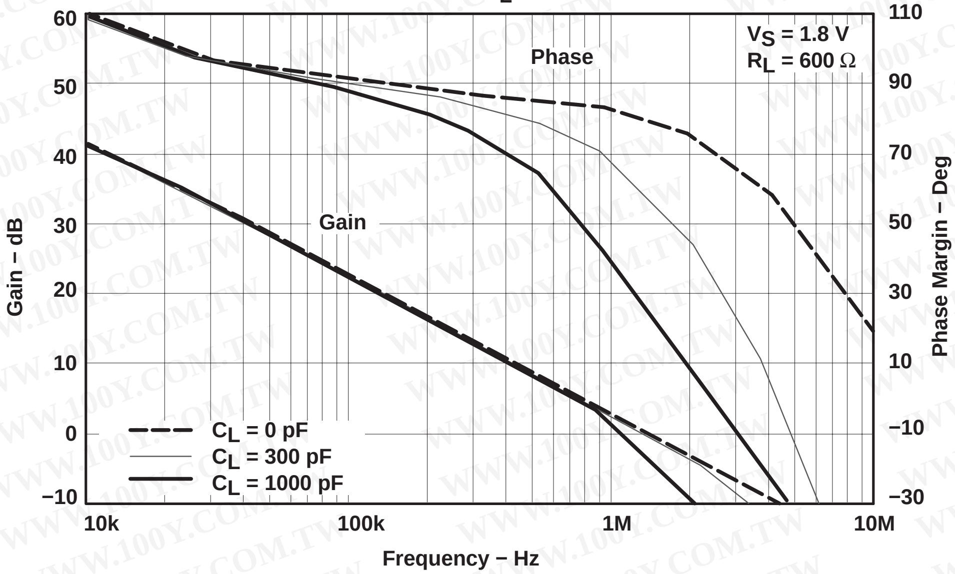

Figure 9

5-V FREQUENCY RESPONSE
vs
C_L

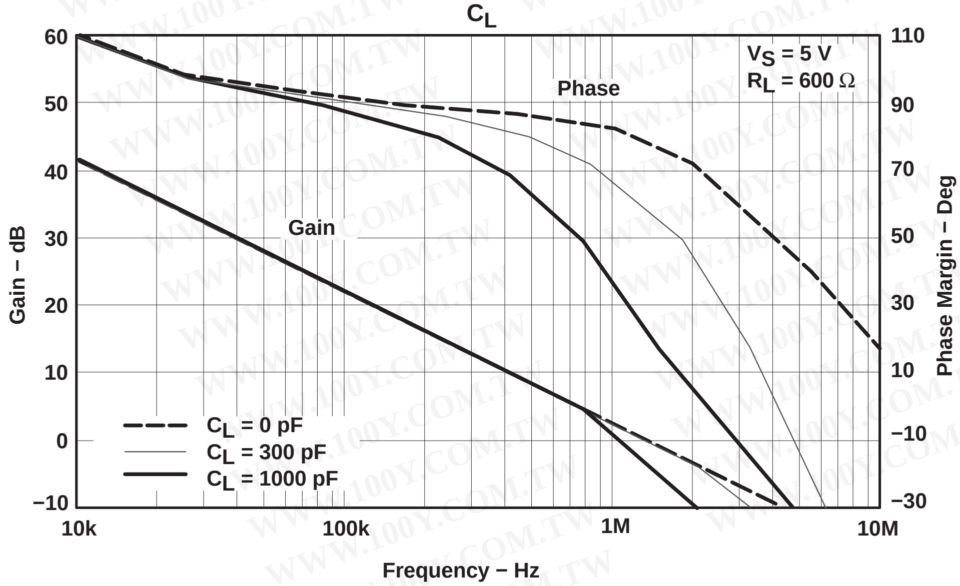

Figure 10

TYPICAL PERFORMANCE CHARACTERISTICS
Unless Otherwise Specified, V_{CC+} = 5 V, Single Supply, T_A = 25°C

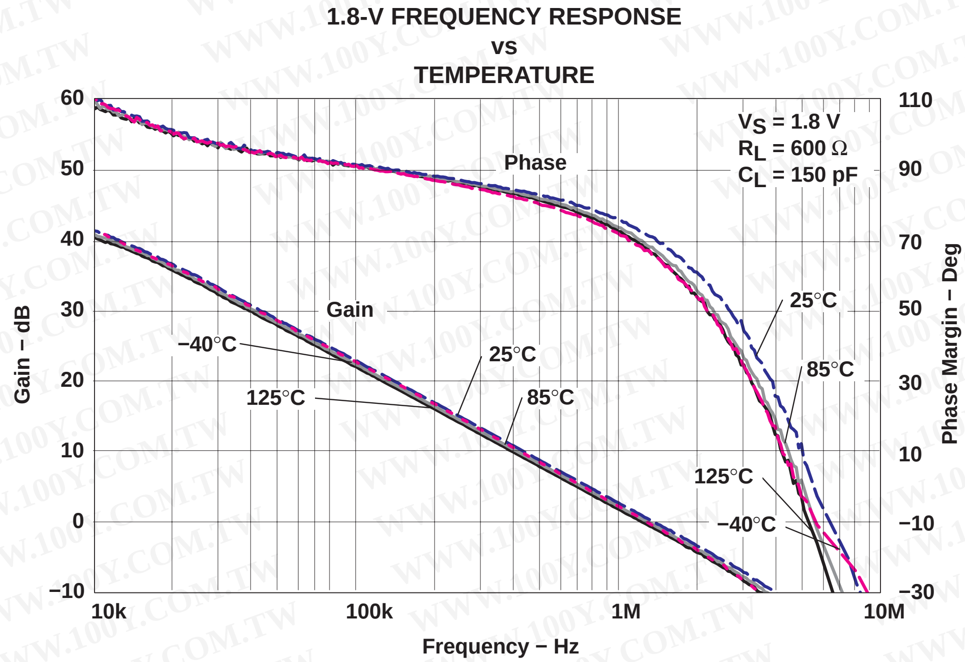

Figure 11

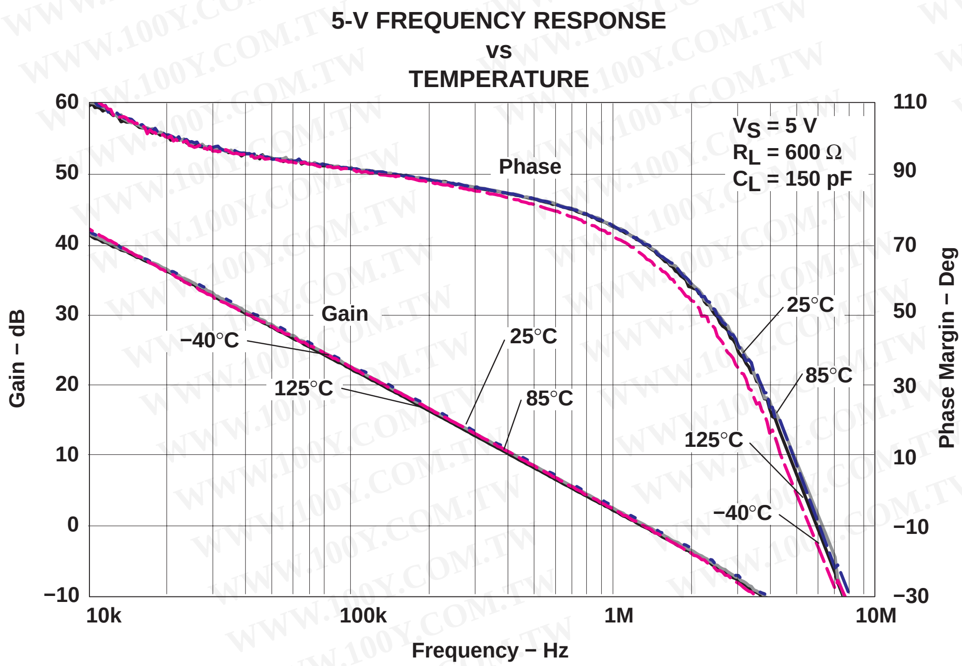

Figure 12

TYPICAL PERFORMANCE CHARACTERISTICS
Unless Otherwise Specified, V_{CC+} = 5 V, Single Supply, T_A = 25°C

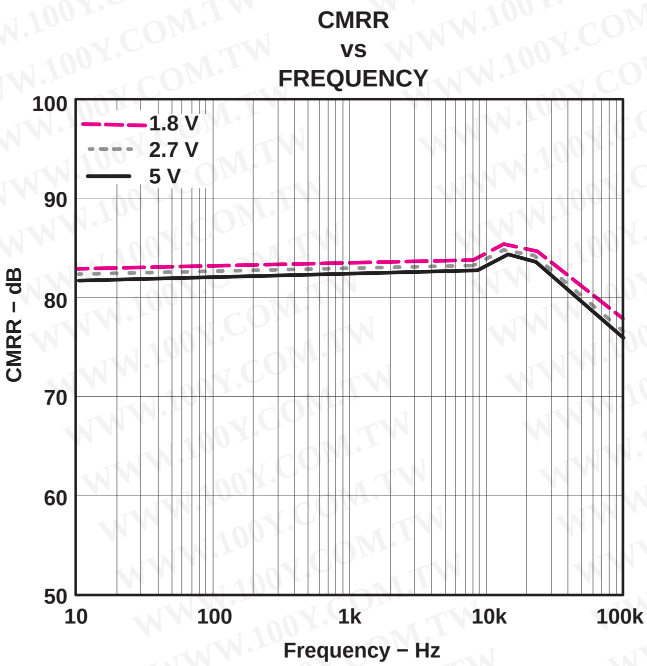

Figure 13

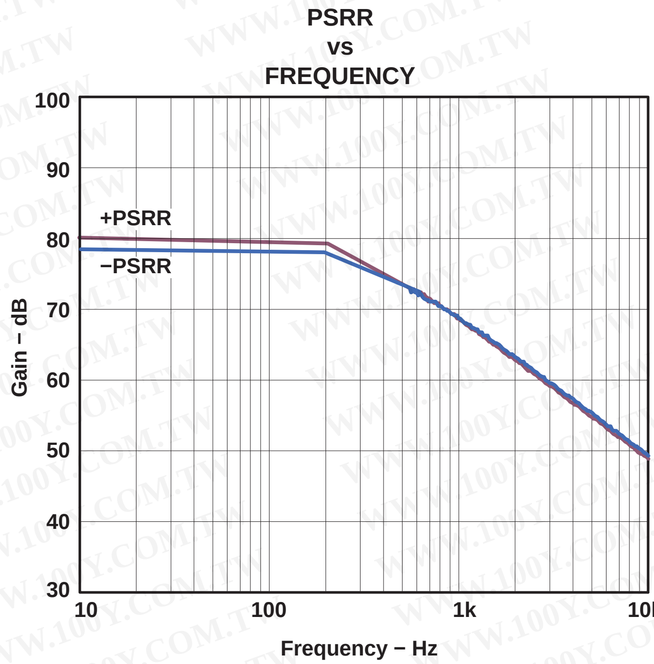

Figure 14

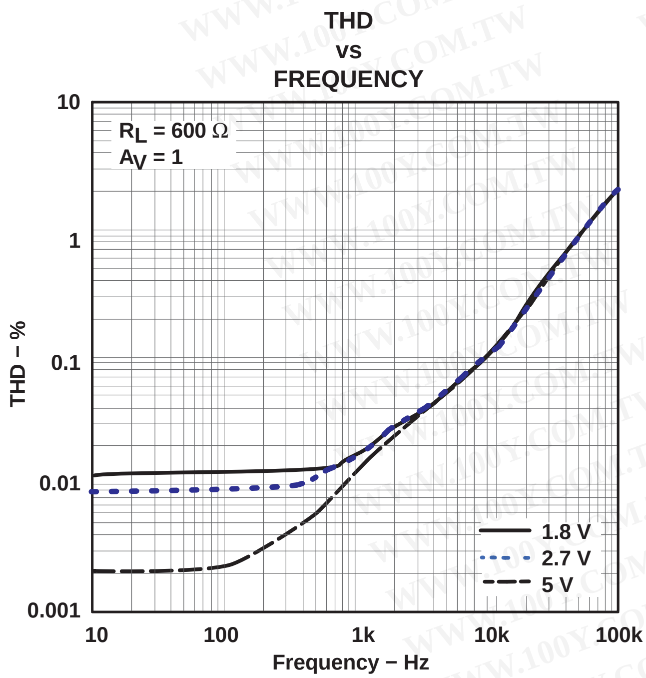

Figure 15

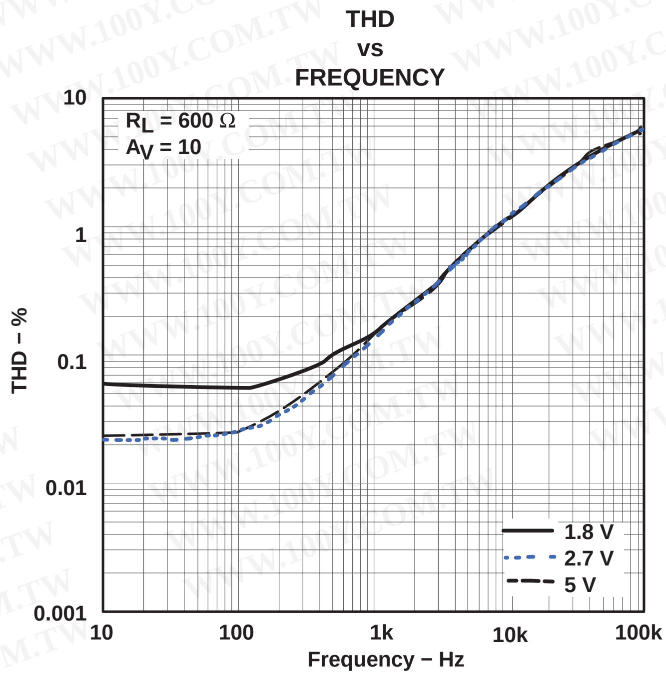

Figure 16

TYPICAL PERFORMANCE CHARACTERISTICS
Unless Otherwise Specified, V_{CC+} = 5 V, Single Supply, T_A = 25°C

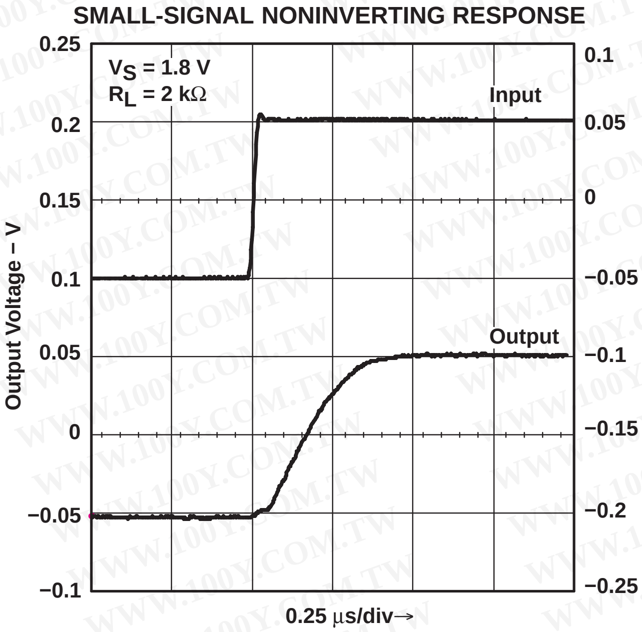

Figure 17

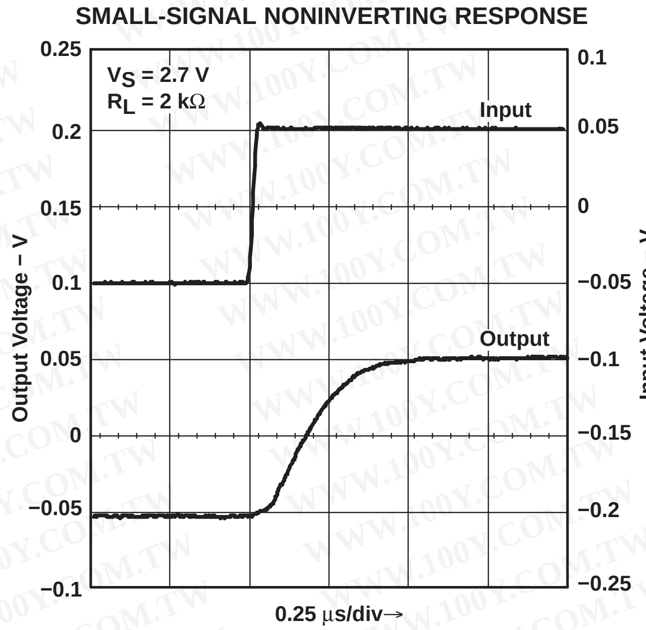

Figure 18

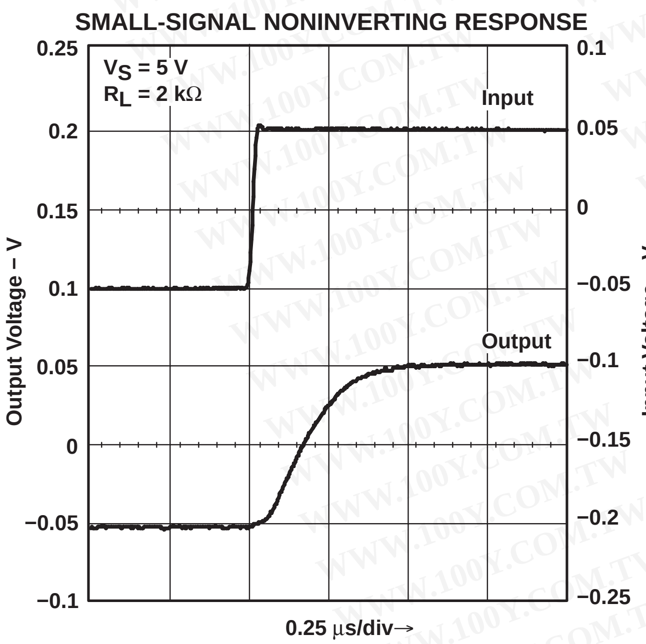

Figure 19

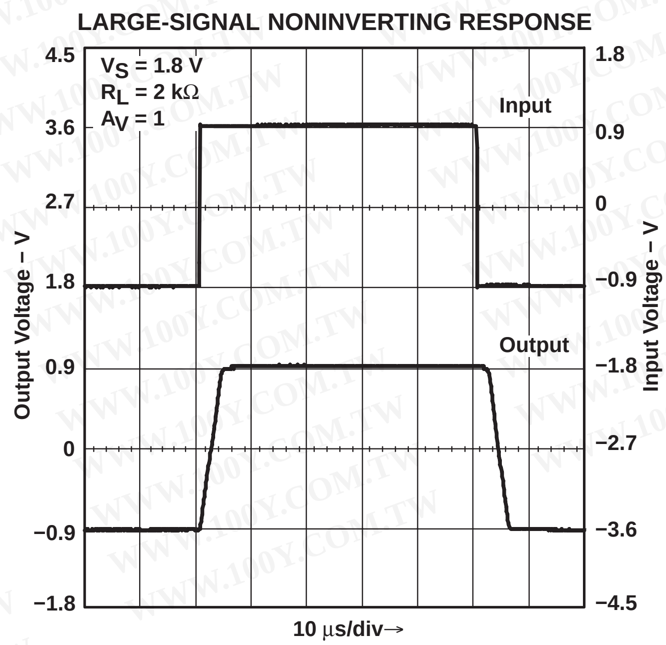

Figure 20

TYPICAL PERFORMANCE CHARACTERISTICS
Unless Otherwise Specified, V_{CC+} = 5 V, Single Supply, T_A = 25°C

LARGE-SIGNAL NONINVERTING RESPONSE

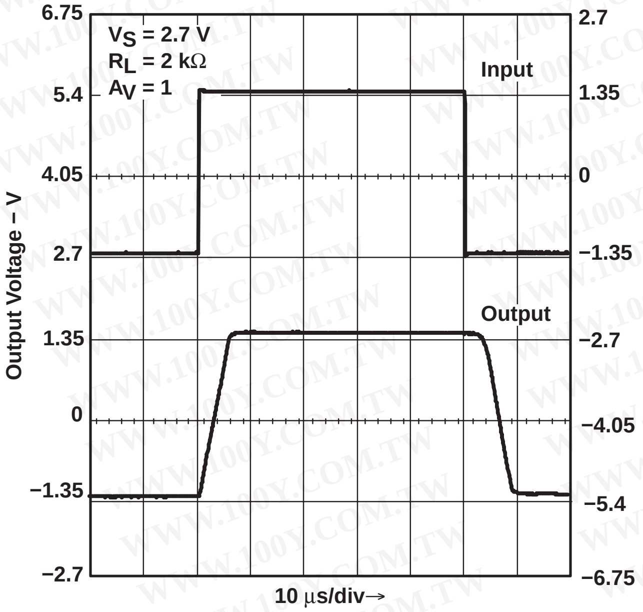

Figure 21

LARGE-SIGNAL NONINVERTING RESPONSE

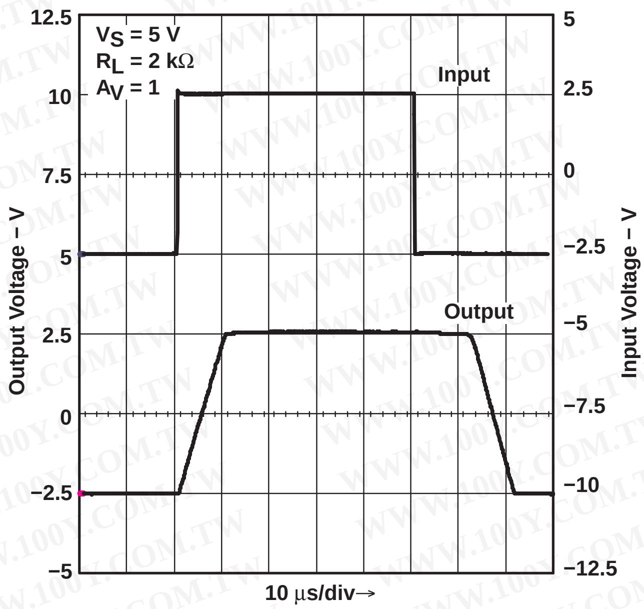

Figure 22

OFFSET VOLTAGE
vs
COMMON-MODE RANGE

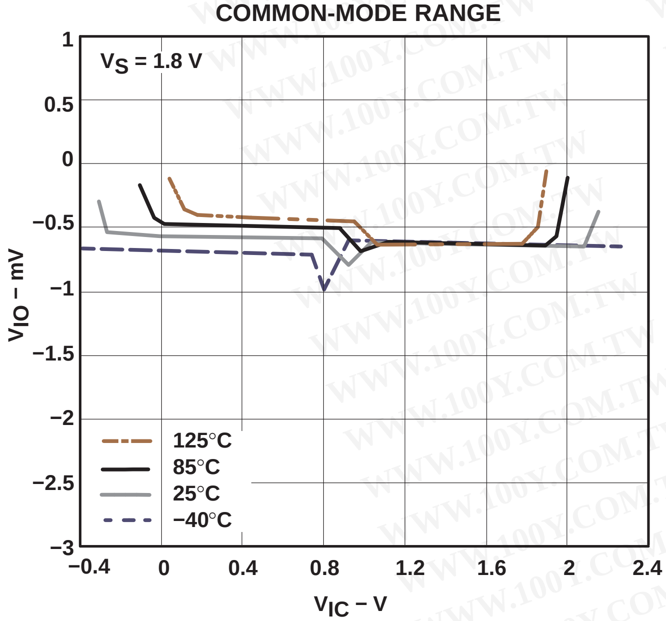

Figure 23

OFFSET VOLTAGE
vs
COMMON-MODE RANGE

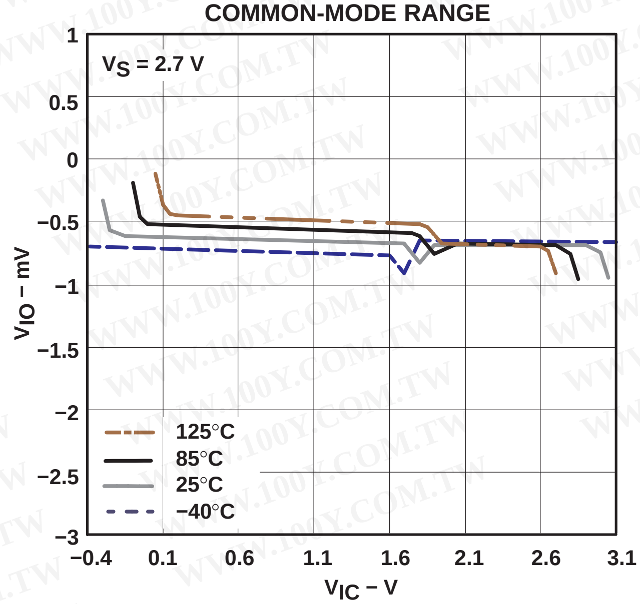

Figure 24

TYPICAL PERFORMANCE CHARACTERISTICS
Unless Otherwise Specified, V_{CC+} = 5 V, Single Supply, T_A = 25°C

OFFSET VOLTAGE vs COMMON-MODE RANGE

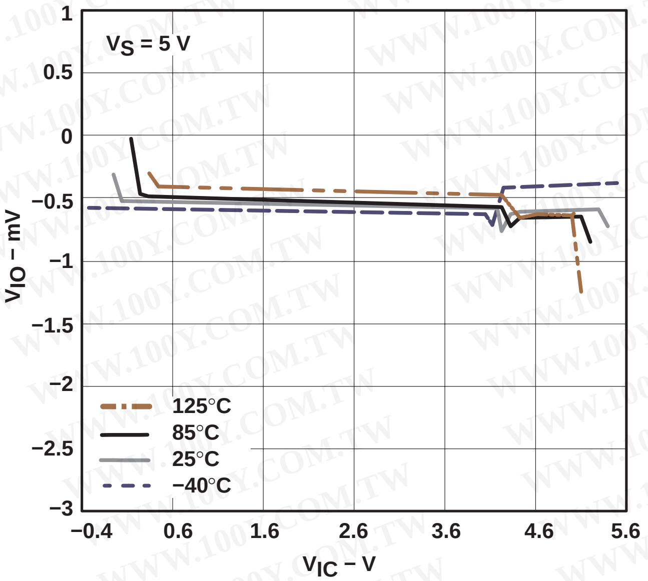

Figure 25

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
LMV931IDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV931IDCKR	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV932IDGKR	PREVIEW	MSOP	DGK	8	2500	None	Call TI	Call TI
LMV934ID	PREVIEW	SOIC	D	14	50	None	Call TI	Call TI
LMV934IDR	PREVIEW	SOIC	D	14	2500	None	Call TI	Call TI
LMV934IPW	PREVIEW	TSSOP	PW	14	90	None	Call TI	Call TI
LMV934IPWR	PREVIEW	TSSOP	PW	14	2000	None	Call TI	Call TI

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - May not be currently available - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
None: Not yet available Lead (Pb-Free).
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Green (RoHS & no Sb/Br): TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDECindustry standard classifications, and peak solder temperature.

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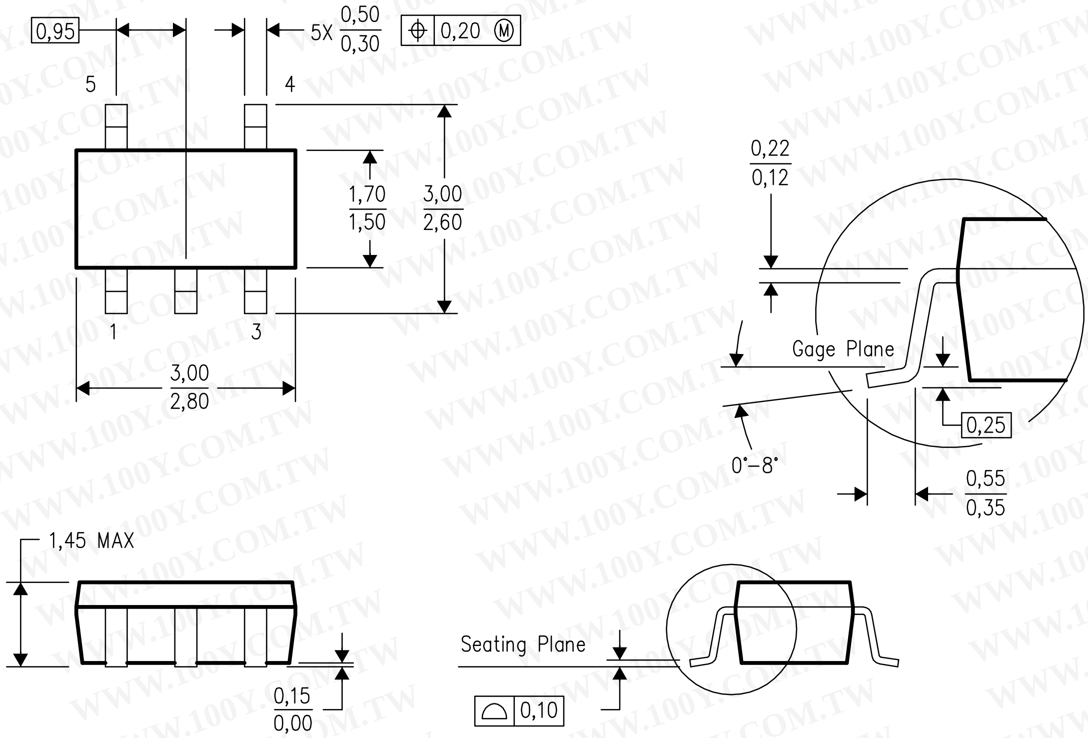
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

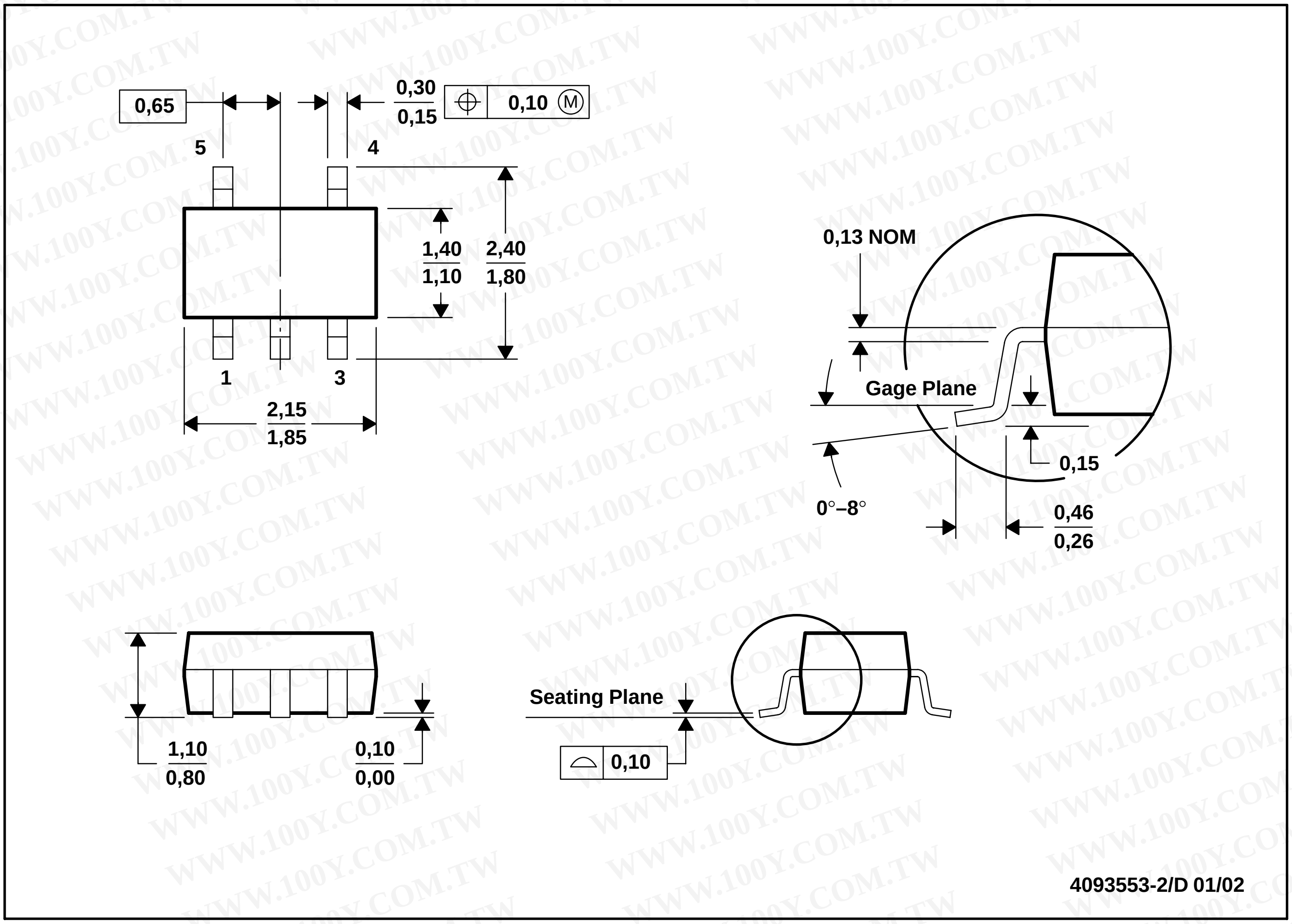
DBV (R-PDSO-G5) PLASTIC SMALL-OUTLINE PACKAGE



4073253-4/H 10/2003

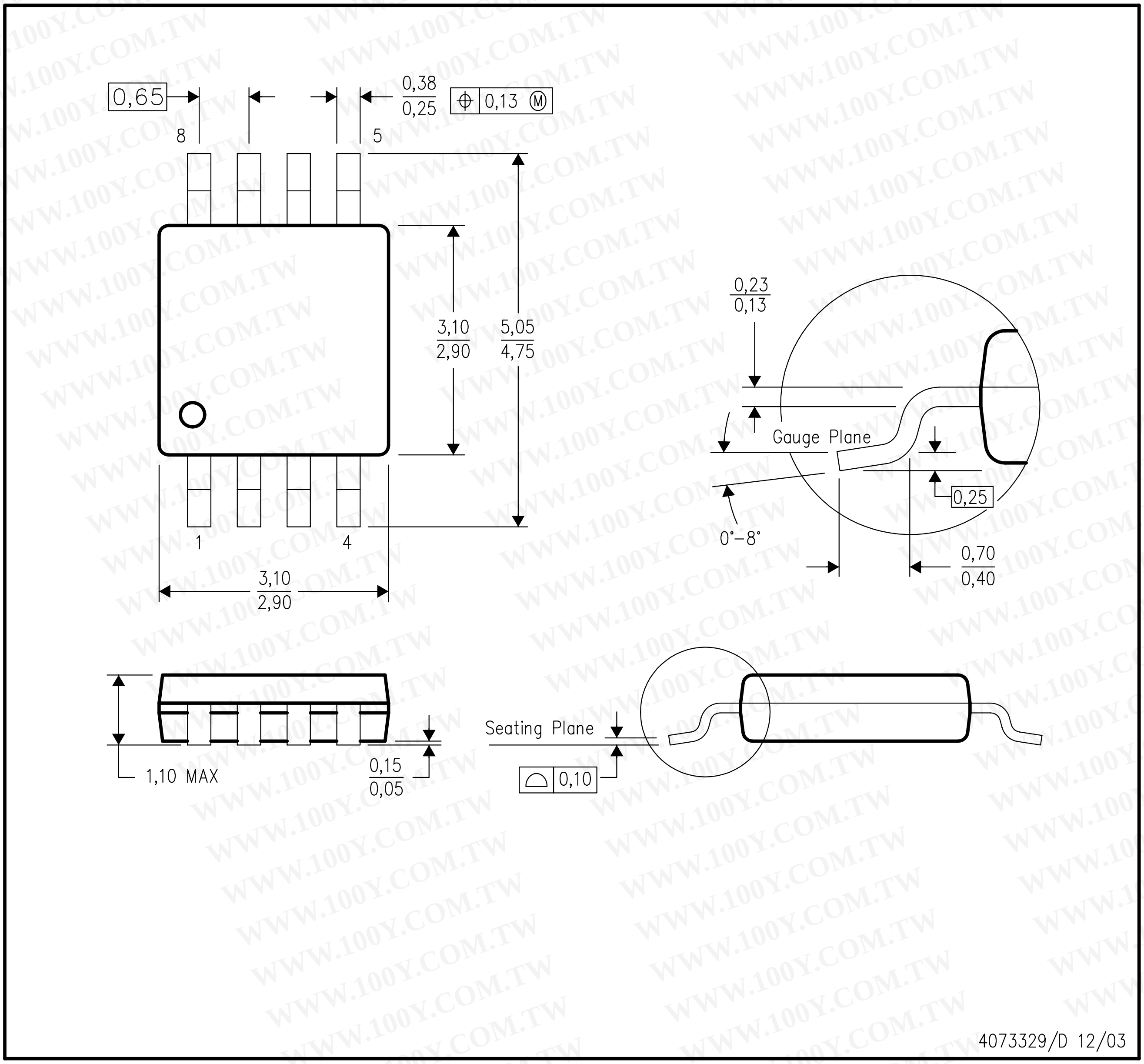
NOTES:
- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion.
- D. Falls within JEDEC MO-178 Variation AA.

DCK (R-PDSO-G5) **PLASTIC SMALL-OUTLINE PACKAGE**



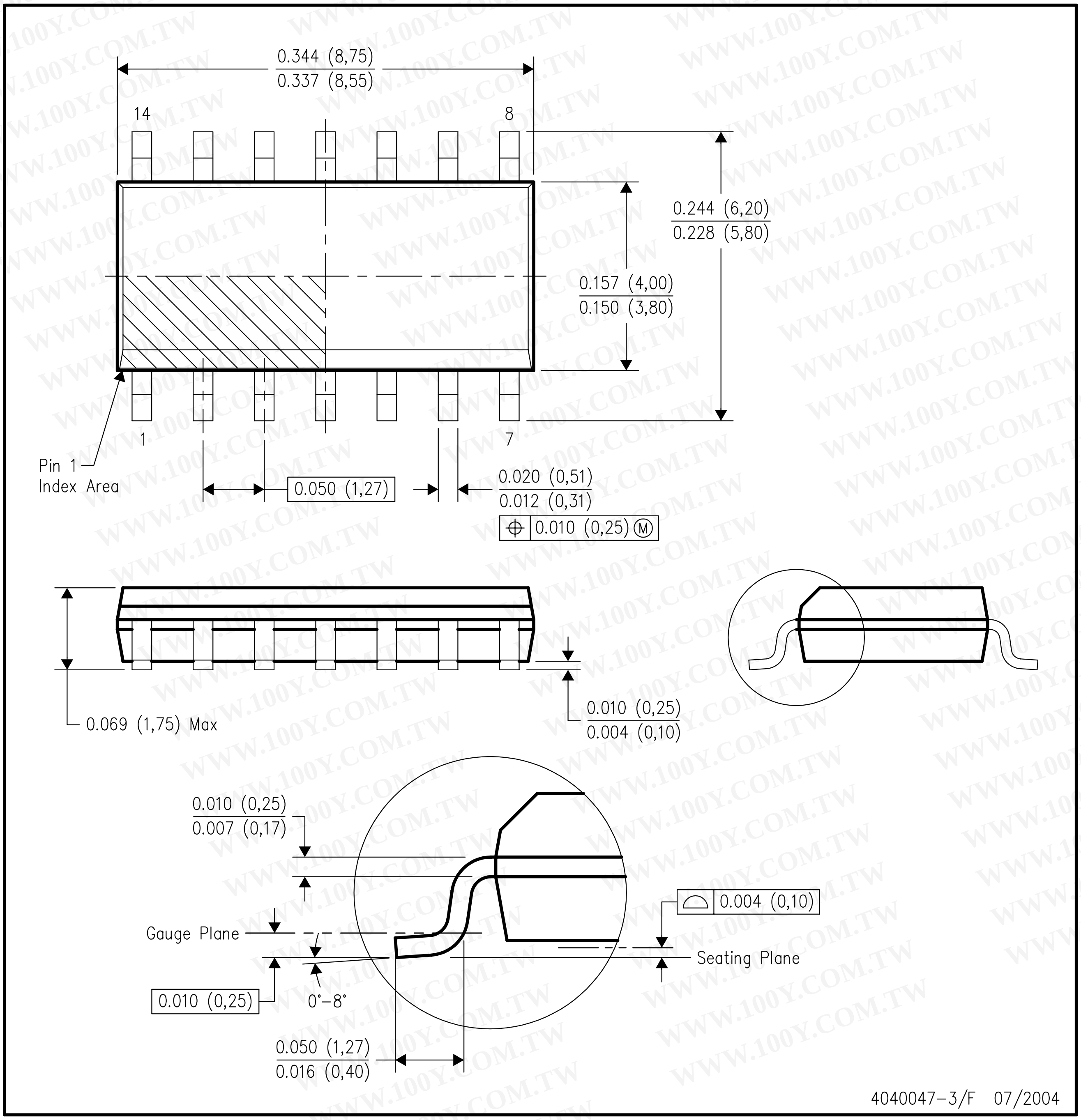
NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.
D. Falls within JEDEC MO-203

DGK (S-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.
D. Falls within JEDEC MO-187 variation AA.

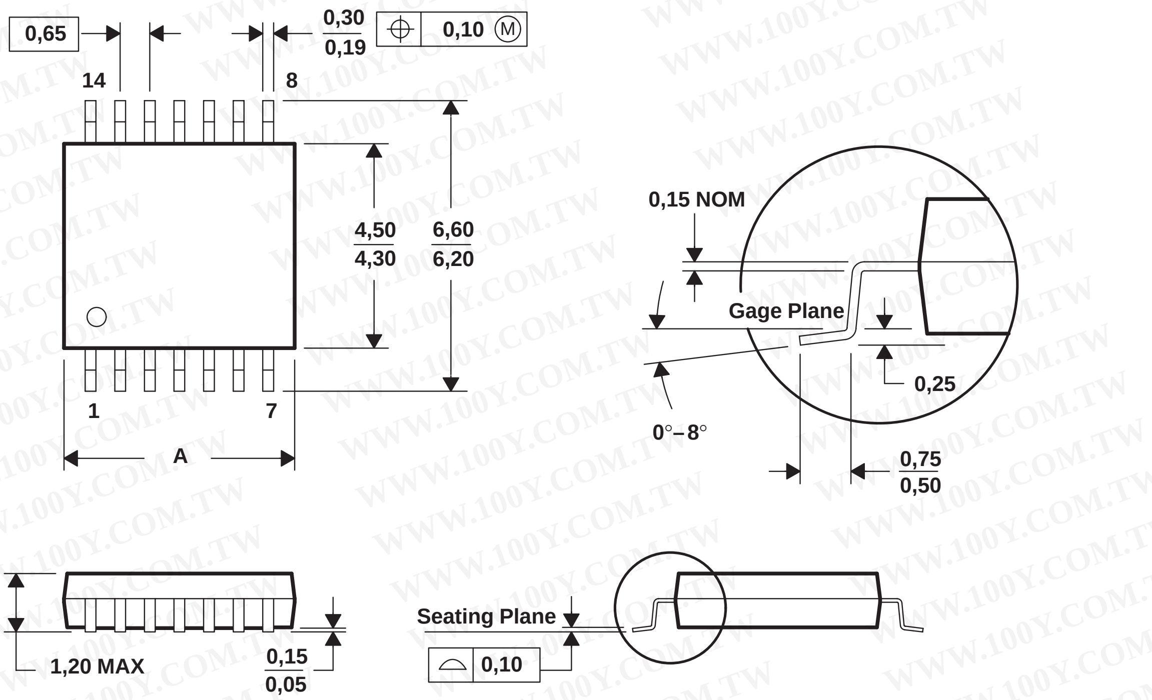
D (R-PDSO-G14) PLASTIC SMALL-OUTLINE PACKAGE



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

PW (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14 PINS SHOWN



PINS ** / DIM	8	14	16	20	24	28
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

4040064/F 01/97

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 not to exceed 0,15.
- D. Falls within JEDEC MO-153