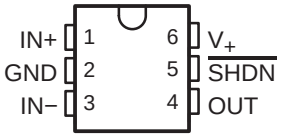
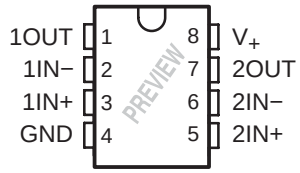
- 2.7-V and 5-V Performance
- Rail-to-Rail Output Swing
- Input Bias Current . . . 1 pA (Typ)
- Input Offset Voltage . . . 0.25 mV (Typ)
- Low Supply Current . . . 100 μA (Typ)
- Low Shutdown Current . . . 45 pA (Typ)
- Gain Bandwidth of 1 MHz (Typ)
- Slew Rate . . . 1 V/μs (Typ)
- Turn-On Time From Shutdown . . . 5 μs Typ
- Input Referred Voltage Noise (at 10 kHz) . . . 20 nV/$\sqrt{\text{Hz}}$
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
- Applications
  - Cordless/Cellular Phones
  - Consumer Electronics (Laptops, PDAs)
  - Audio Pre-Amps for Voice
  - Portable/Battery-Powered Electronic Equipment
  - Supply-Current Monitoring
  - Battery Monitoring
  - Buffers
  - Filters
  - Drivers

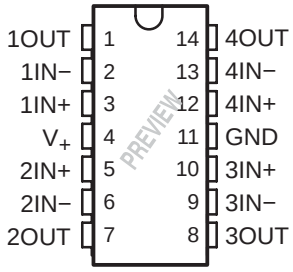
LMV341 . . . DBV (SOT-23) OR DCK (SC-70) PACKAGE
(TOP VIEW)



LMV342 . . . D (SOIC), DDU (VSSOP), OR DGK (MSOP) PACKAGE
(TOP VIEW)



LMV344 . . . D (SOIC) OR PW (TSSOP) PACKAGE
(TOP VIEW)



description/ordering information

The LMV341, LMV342, LMV344 devices are single, dual, and quad CMOS operational amplifiers, respectively, with low voltage, low power, and rail-to-rail output swing capabilities. The PMOS input stage offers an ultra-low input bias current of 1 pA (typ) and an offset voltage of 0.25 mV (typ). The single supply amplifier is designed specifically for low-voltage (2.7 V to 5 V) operation, with a wide common-mode input voltage range that typically extends from −0.2 V to 0.8 V from the positive supply rail. The LMV341 (single) also offers a shutdown pin that can be used to disable the device. In shutdown mode, the supply current is reduced to 33 nA (typical). Additional features of the family are a 20 nV/$\sqrt{\text{Hz}}$ voltage noise at 10 kHz, 1-MHz unity-gain bandwidth, 1-V/μs slew rate, and 100-μA current consumption per channel.

description/ordering information (continued)

Offered in both the SOT-23 and smaller SC-70 packages, the LMV341 is suitable for the most space-constraint applications. The LMV342 dual device is offered in the standard SOIC and MSOP packages. Additional space saving is achieved with the ultra-small VSSOP (DDU) package that occupies ~58% less board space than the MSOP package. An extended industrial temperature range from −40°C to 125°C makes these devices suitable in a wide variety of commercial and industrial environments.

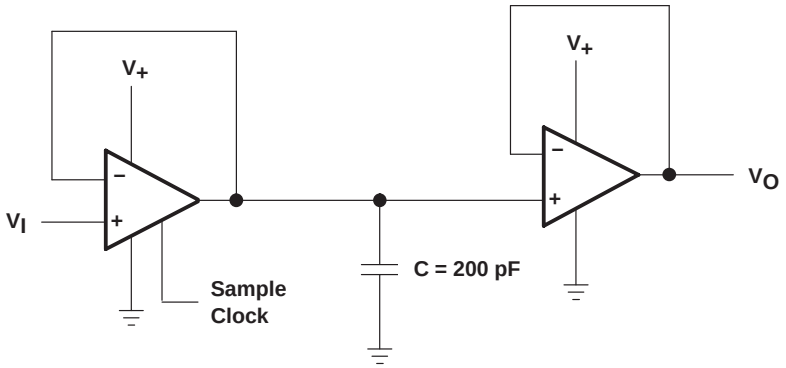
ORDERING INFORMATION

T_A	PACKAGE†			ORDERABLE PART NUMBER	TOP-SIDE MARKING‡
−40°C to 125°C	Single	SOT-23 (DBV)	Reel of 3000	LMV341IDBVR	RC9_
			Reel of 250	LMV341IDBVT	PREVIEW
		SC-70 (DCK)	Reel of 3000	LMV341IDCKR	R4_
			Reel of 250	LMV341IDCKT	PREVIEW
	Dual	SOIC (D)	Tube of 75	LMV342ID	PREVIEW
			Reel of 2500	LMV342IDR	
		MSOP/VSSOP (DGK)	Reel of 2500	LMV342IDGKR	PREVIEW
			Reel of 250	LMV342IDGKTT	
		VSSOP (DDU)	Reel of 200	LMV342IDDUR	PREVIEW
	Quad	SOIC (D)	Tube of 50	LMV344ID	PREVIEW
			Reel of 2500	LMV344IDR	
		TSSOP (PW)	Tube of 90	LMV344IPW	PREVIEW
			Reel of 2000	LMV344IPWR	

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

‡ The actual top-side marking has one additional character that designates the assembly/test site.

application circuit: sample and hold circuit



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

Supply voltage, V_+ (see Note 1) . . . . . 5.5 V
Differential input voltage, V_{ID} (see Note 2) . . . . . ±5.5 V
Input voltage, V_I (either input) . . . . . 0 to 5.5 V
Package thermal impedance, θ_{JA} (see Notes 3 and 4): D package (8 pin) . . . . . 97°C/W
D package (14 pin) . . . . . 86°C/W
DBV package . . . . . 165°C/W
DCK package . . . . . 259°C/W
DDU package . . . . . TBD°C/W
DGK package . . . . . 172°C/W
PW package . . . . . 113°C/W
Operating virtual junction temperature . . . . . 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_+ 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. 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 $P_D = (T_J(max) - T_A)/\theta_{JA}$. Selecting the maximum of 150°C can affect reliability.
4. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 5)

		MIN	MAX	UNIT
V_+	Supply voltage (single-supply operation)	2.5	5.5	V
T_A	Operating free-air temperature	−40	125	°C

NOTE 5: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

ESD protection

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

electrical characteristics, V_+ = 2.7 V, GND = 0, $V_{IC} = V_O = V_+/2$, $R_L > 1$ MΩ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A	MIN	TYP†	MAX	UNIT
V_{IO}	Input offset voltage			25°C		0.25	4	mV
				Full range			4.5	
$\alpha_{V_{IO}}$	Average temperature coefficient of input offset voltage			Full range		1.7		µV/°C
I_{IB}	Input bias current			25°C		1	120	pA
				−40°C to 85°C			250	
				−40°C to 125°C			1	nA
I_{IO}	Input offset current			25°C		6.6		fA
CMRR	Common-mode rejection ratio	$0 \le V_{ICR} \le 1.7$ V		25°C	56	80		dB
		$0 \le V_{ICR} \le 1.6$ V		Full range	50			
k_{SVR}	Supply-voltage rejection ratio	2.7 V ≤ V_+ ≤ 5 V		25°C	65	82		dB
				Full range	60			
V_{ICR}	Common-mode input voltage range	CMRR ≥ 50 dB		25°C	0	−0.2 to 1.9	1.7	V
A_V	Large-signal voltage gain (see Note 6)	R_L = 10 kΩ to 1.35 V		25°C	78	113		dB
				Full range	70			
		R_L = 2 kΩ to 1.35 V		25°C	72	103		
				Full range	64			
V_O	Output swing (delta from supply rails)	R_L = 2 kΩ to 1.35 V	Low level	25°C		24	60	mV
				Full range			95	
			High level	25°C		26	60	
				Full range			95	
		R_L = 10 kΩ to 1.35 V	Low level	25°C		5	30	
				Full range			40	
			High level	25°C		5.3	30	
				Full range			40	
I_{CC}	Supply current (per channel)			25°C		100	170	µA
				Full range			230	
I_{OS}	Output short-circuit current	Sourcing	LMV341, LMV342	25°C	20	32		mA
			LMV344		18	24		
		Sinking			15	24		
SR	Slew rate	R_L = 10 kΩ, Note 7		25°C		1		V/µs
GBM	Unity-gain bandwidth	R_L = 100 kΩ, C_L = 200 pF		25°C		1		MHz
Φ_m	Phase margin	R_L = 100 kΩ		25°C		72		deg
G_m	Gain margin	R_L = 100 kΩ		25°C		20		dB
V_n	Equivalent input noise voltage	f = 1 kHz		25°C		40		nV/√Hz
I_n	Equivalent input noise current	f = 1 kHz		25°C		0.001		pA/√Hz
THD	Total harmonic distortion	f = 1 kHz, A_V = 1, R_L = 600 Ω, V_I = 1 V_{PP}		25°C		0.017		%

† Typical values represent the most likely parametric norm.

NOTES: 6. GND + 0.2 V ≤ V_O ≤ V_{CC+} − 0.2 V
7. Connected as voltage follower with 2-V_{PP} step input. Number specified is the slower of the positive and negative slew rates.

shutdown characteristics, V_+ = 2.7 V, GND = 0, $V_{IC} = V_O = V_+/2$, R_L > 1 MΩ (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
$I_{CC(SHDN)}$	Supply current in shutdown mode	V_{SD} = 0 V	25°C		0.045	1	μA
		V_{SD} = 0 V	Full range			1.5	μA
$t_{(on)}$	Amplifier turn-on time		25°C		5		μs
V_{SD}	Shutdown pin voltage range	ON mode	25°C		1.7 to 2.7	2.4 to 2.7	V
		Shutdown mode			0 to 1	0 to 0.8	

electrical characteristics, V_+ = 5 V, GND = 0, $V_{IC} = V_O = V_+/2$, $R_L > 1$ MΩ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A	MIN	TYP†	MAX	UNIT
V_{IO}	Input offset voltage			25°C		0.25	4	mV
				Full range			4.5	
$\alpha_{V_{IO}}$	Average temperature coefficient of input offset voltage			Full range		1.9		μV/°C
I_{IB}	Input bias current			25°C		1	200	pA
				−40°C to 85°C			375	
				−40°C to 125°C			1	nA
I_{IO}	Input offset current			25°C		6.6		fA
CMRR	Common-mode rejection ratio	$0 \le V_{ICR} \le 4$ V		25°C	56	86		dB
		$0 \le V_{ICR} \le 3.9$ V		Full range	50			
k_{SVR}	Supply-voltage rejection ratio	2.7 V ≤ V_+ ≤ 5 V		25°C	65	82		dB
				Full range	60			
V_{ICR}	Common-mode input voltage range	CMRR ≥ 50 dB		25°C	0	−0.2 to 4.2	4	V
A_V	Large-signal voltage gain (see Note 6)	R_L = 10 kΩ to 2.5 V		25°C	78	116		dB
				Full range	70			
		R_L = 2 kΩ to 2.5 V		25°C	72	107		
				Full range	64			
V_O	Output swing (delta from supply rails)	R_L = 2 kΩ to 2.5 V	Low level	25°C		32	60	mV
				Full range			95	
			High level	25°C		34	60	
				Full range			95	
		R_L = 10 kΩ to 2.5 V	Low level	25°C		7	30	
				Full range			40	
			High level	25°C		7	30	
				Full range			40	
I_{CC}	Supply current (per channel)			25°C		107	200	μA
				Full range			260	
I_{OS}	Output short-circuit current	Sourcing	LMV341, LMV342	25°C	85	113		mA
			LMV344		PREVIEW			
		Sinking			50	75		
SR	Slew rate	R_L = 10 kΩ, Note 7		25°C		1		V/μs
GBM	Unity-gain bandwidth	R_L = 10 kΩ, C_L = 200 pF		25°C		1		MHz
Φ_m	Phase margin	R_L = 100 kΩ		25°C		70		deg
G_m	Gain margin	R_L = 100 kΩ		25°C		20		dB
V_n	Equivalent input noise voltage	f = 1 kHz		25°C		39		nV/√Hz
I_n	Equivalent input noise current	f = 1 kHz		25°C		0.001		pA/√Hz
THD	Total harmonic distortion	f = 1 kHz, A_V = 1, R_L = 600 Ω, V_I = 1 V_{PP}		25°C		0.012		%

† Typical values represent the most likely parametric norm.

NOTES: 6. GND + 0.2 V ≤ $V_O \le V_{CC+}$ − 0.2 V

7. Connected as voltage follower with 2-V_{PP} step input. Number specified is the slower of the positive and negative slew rates.

shutdown characteristics, V_+ = 5 V, GND = 0, $V_{IC} = V_O = V_+/2$, R_L > 1 MΩ (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
$I_{CC(SHDN)}$	Supply current in shutdown mode	V_{SD} = 0 V	25°C		0.033	1	μA
			Full range			1.5	
$t_{(on)}$	Amplifier turn-on time		25°C		5		μs
V_{SD}	Shutdown pin voltage range	ON mode	25°C		3.1 to 5	4.5 to 5	V
		Shutdown mode			0 to 1	0 to 0.8	

TYPICAL PERFORMANCE CHARACTERISTICS

SUPPLY CURRENT vs SUPPLY VOLTAGE

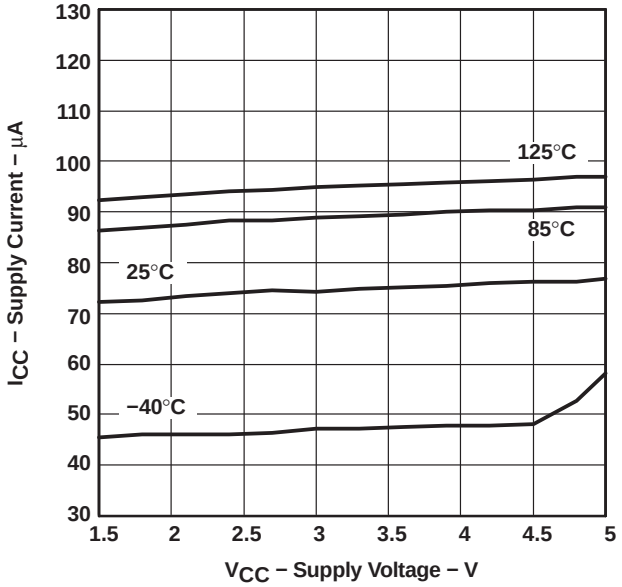


Figure 1

INPUT BIAS CURRENT vs TEMPERATURE

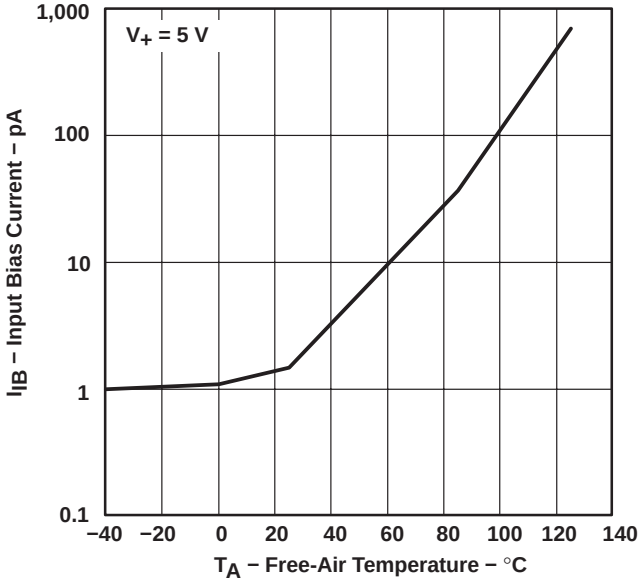


Figure 2

OUTPUT VOLTAGE SWING vs SUPPLY VOLTAGE

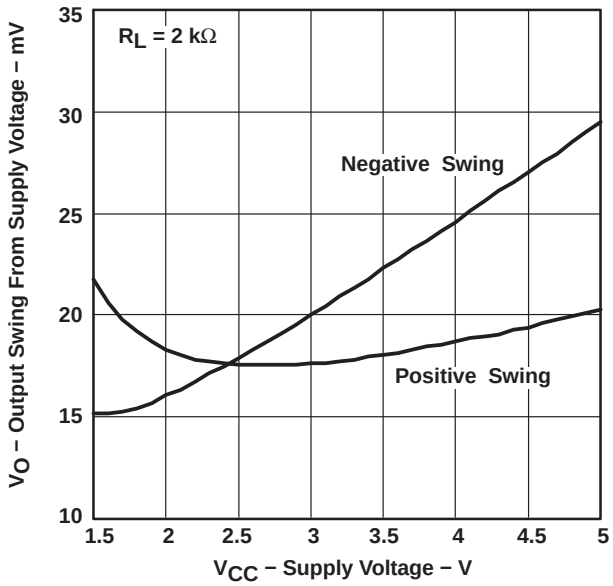


Figure 3

OUTPUT VOLTAGE SWING vs SUPPLY VOLTAGE

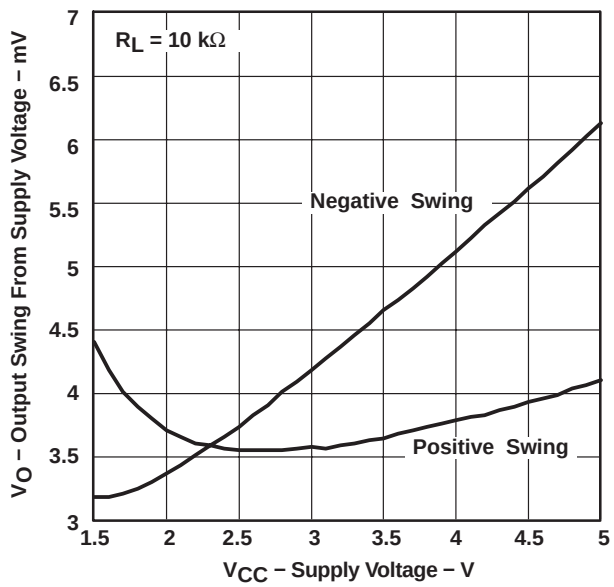


Figure 4

TYPICAL PERFORMANCE CHARACTERISTICS

SOURCE CURRENT
vs
OUTPUT VOLTAGE

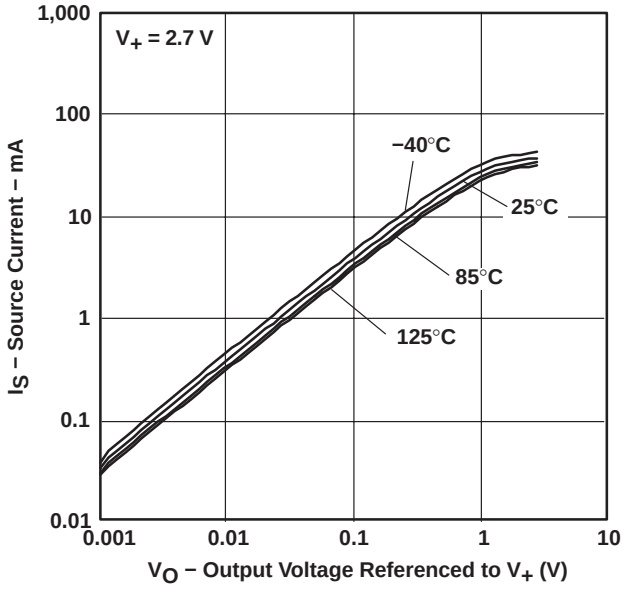


Figure 5

SOURCE CURRENT
vs
OUTPUT VOLTAGE

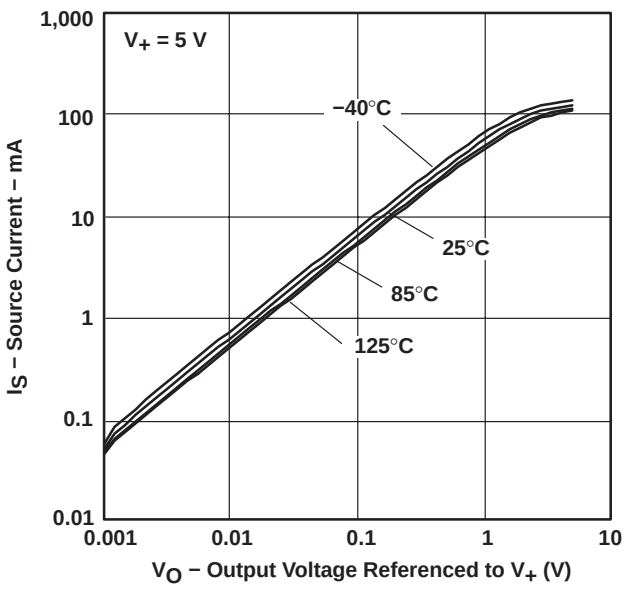


Figure 6

SINK CURRENT
vs
OUTPUT VOLTAGE

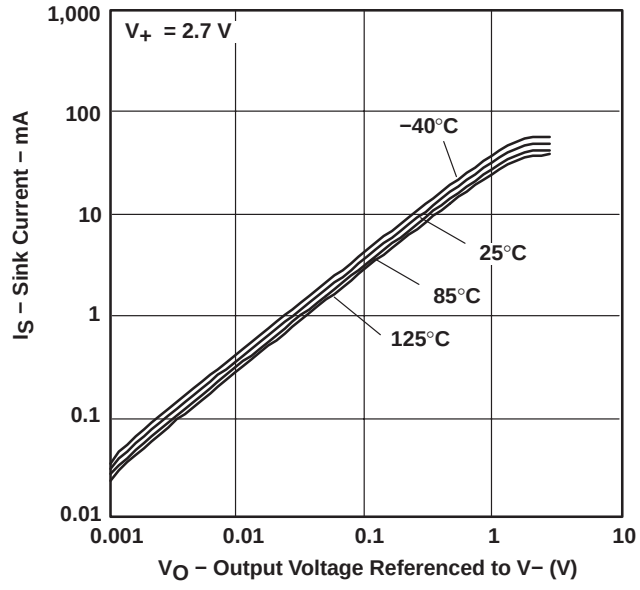


Figure 7

SINK CURRENT
vs
OUTPUT VOLTAGE

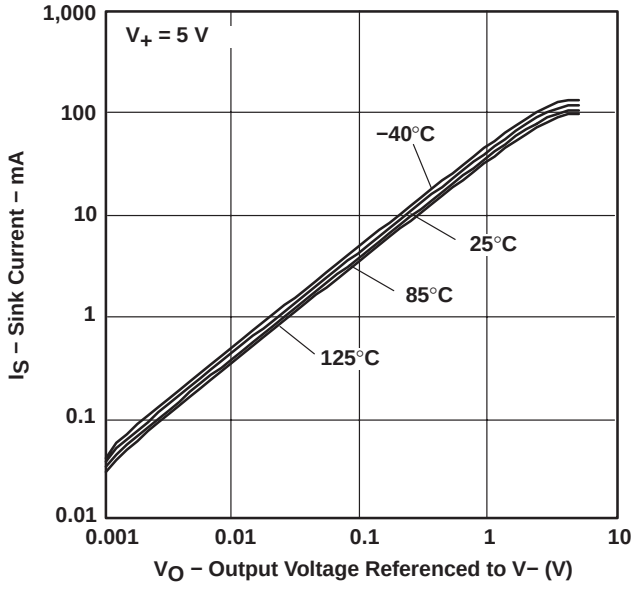


Figure 8

TYPICAL PERFORMANCE CHARACTERISTICS

OFFSET VOLTAGE
vs
COMMON-MODE VOLTAGE

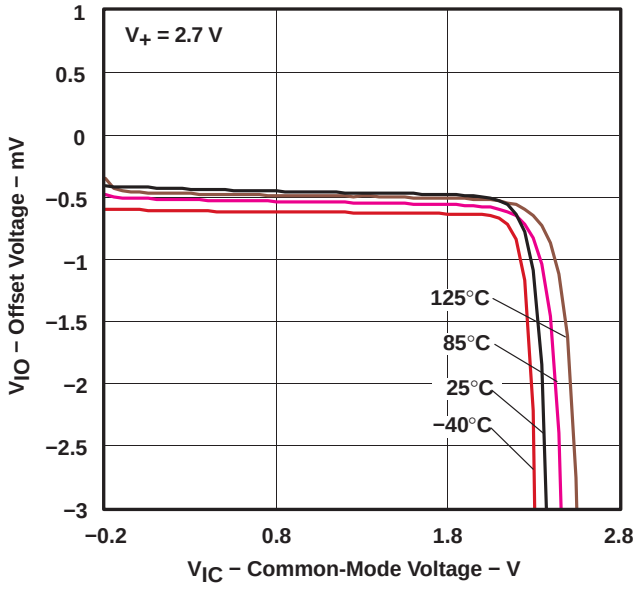


Figure 9

OFFSET VOLTAGE
vs
COMMON-MODE VOLTAGE

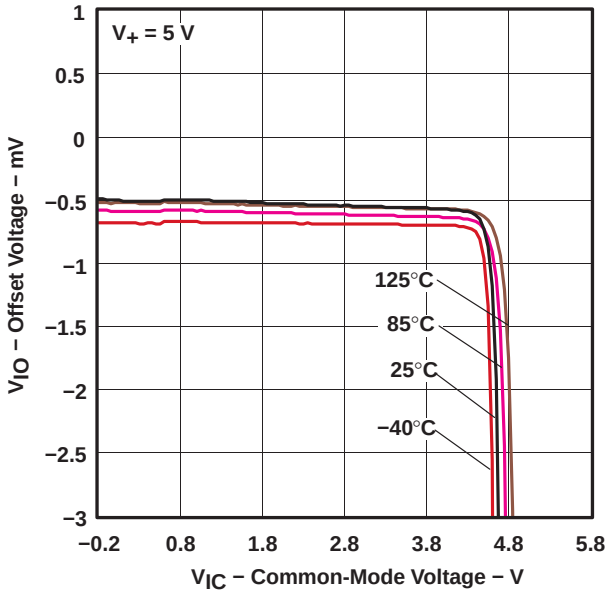


Figure 10

INPUT VOLTAGE
vs
OUTPUT VOLTAGE

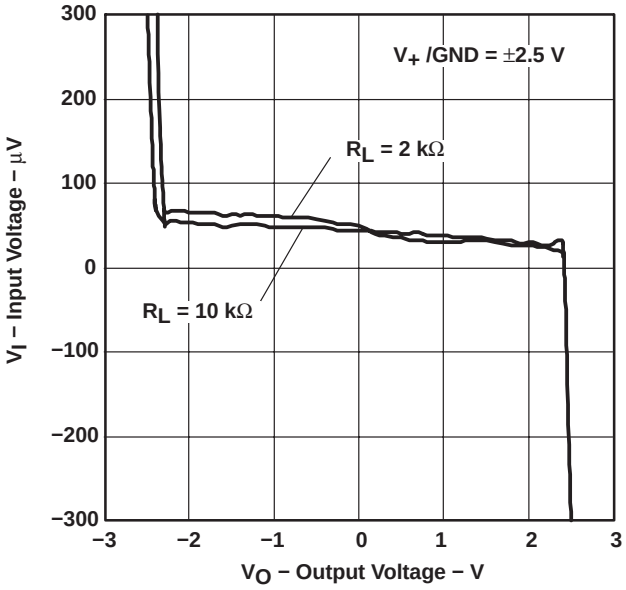


Figure 11

INPUT VOLTAGE
vs
OUTPUT VOLTAGE

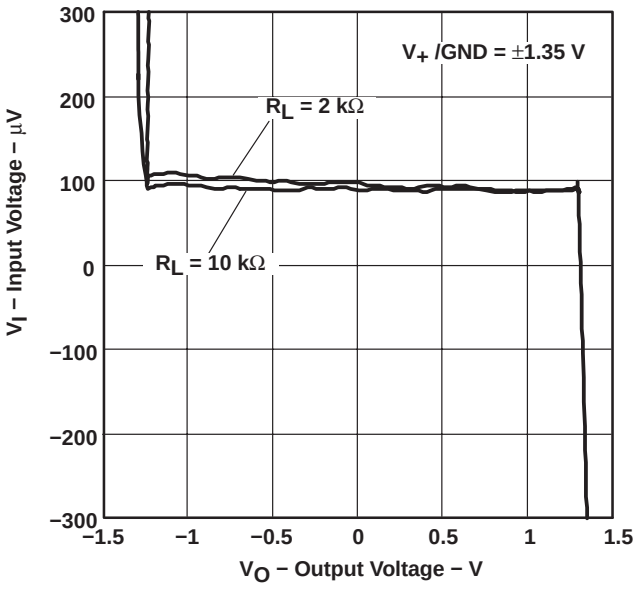


Figure 12

TYPICAL PERFORMANCE CHARACTERISTICS

SLEW RATE vs SUPPLY VOLTAGE

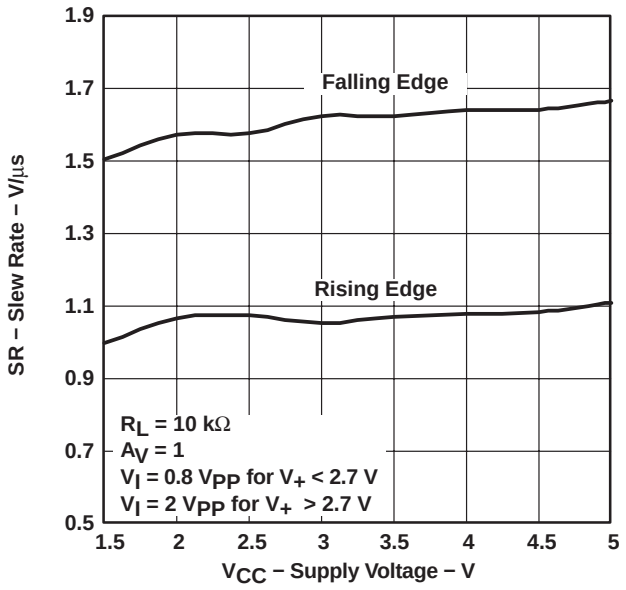


Figure 13

SLEW RATE vs TEMPERATURE

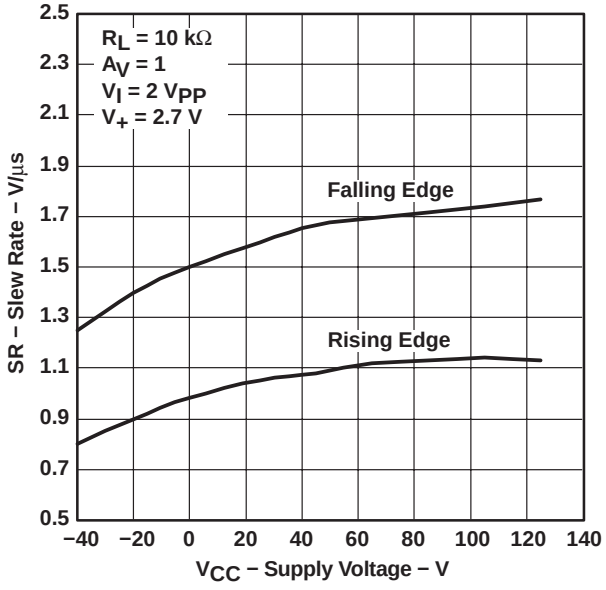


Figure 14

SLEW RATE vs TEMPERATURE

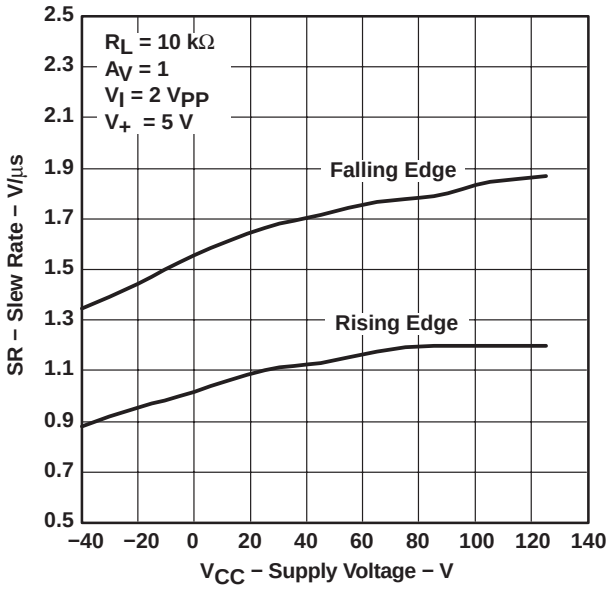


Figure 15

CMRR vs FREQUENCY

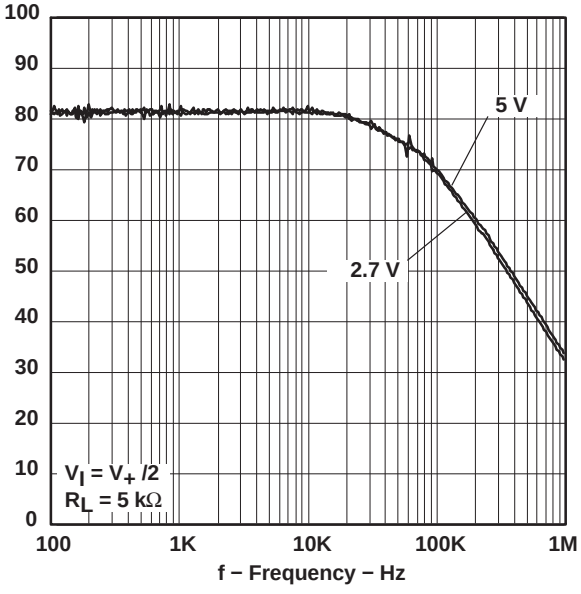


Figure 16

TYPICAL PERFORMANCE CHARACTERISTICS

PSRR vs FREQUENCY

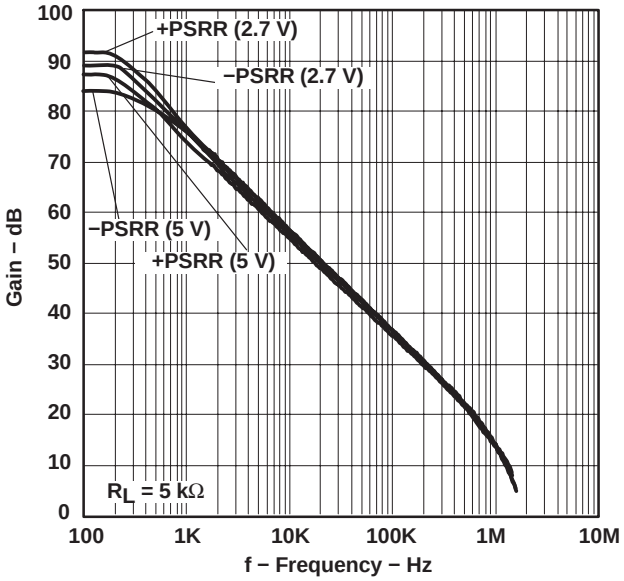


Figure 17

INPUT VOLTAGE NOISE vs FREQUENCY

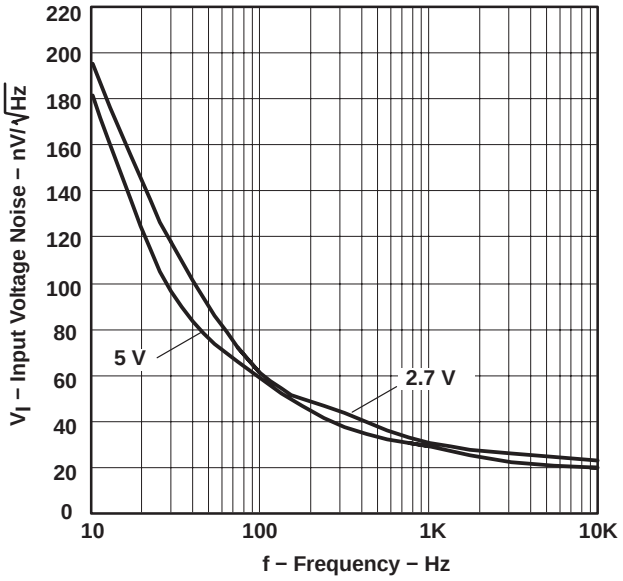


Figure 18

TOTAL HARMONIC DISTORTION + NOISE vs FREQUENCY

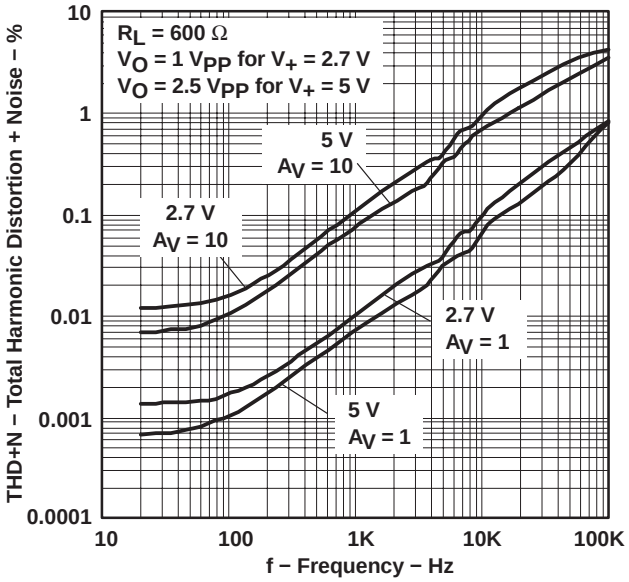


Figure 19

TOTAL HARMONIC DISTORTION + NOISE vs OUTPUT VOLTAGE

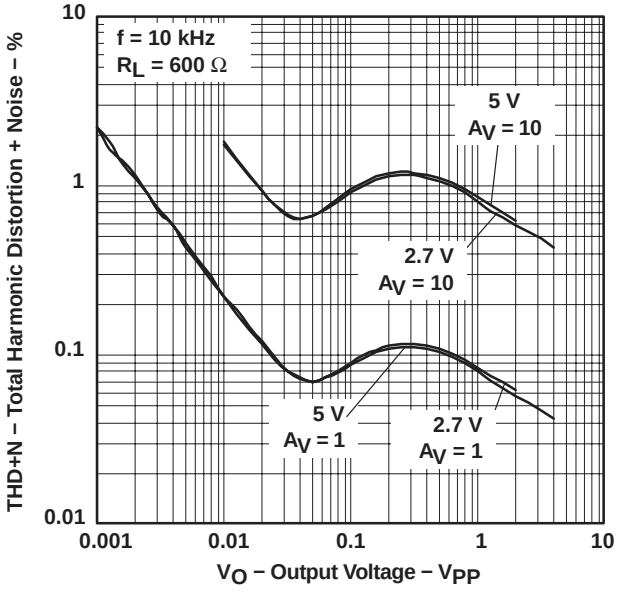


Figure 20

TYPICAL PERFORMANCE CHARACTERISTICS

FREQUENCY RESPONSE vs TEMPERATURE

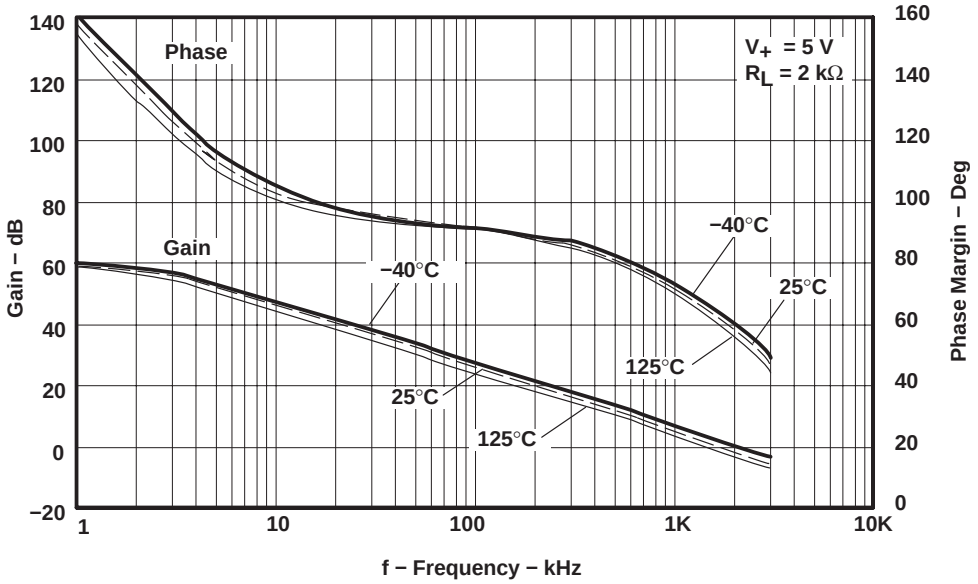


Figure 21

FREQUENCY RESPONSE vs R_L

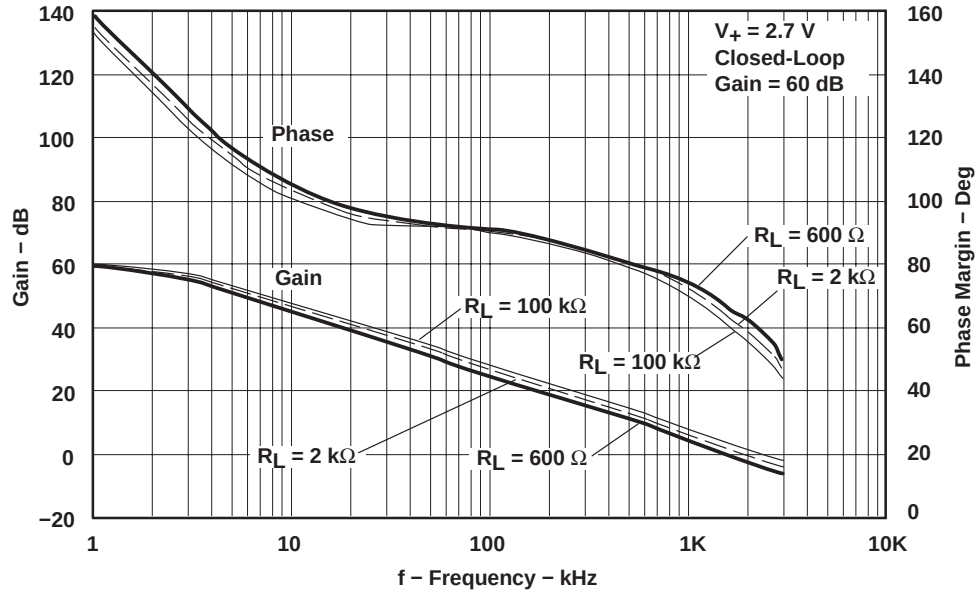


Figure 22

TYPICAL PERFORMANCE CHARACTERISTICS

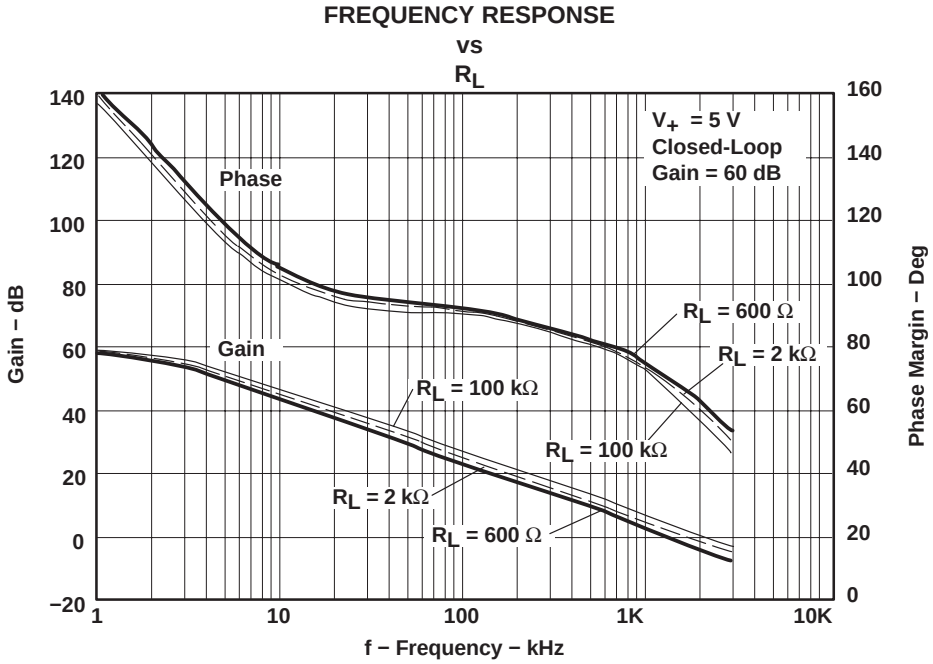


Figure 23

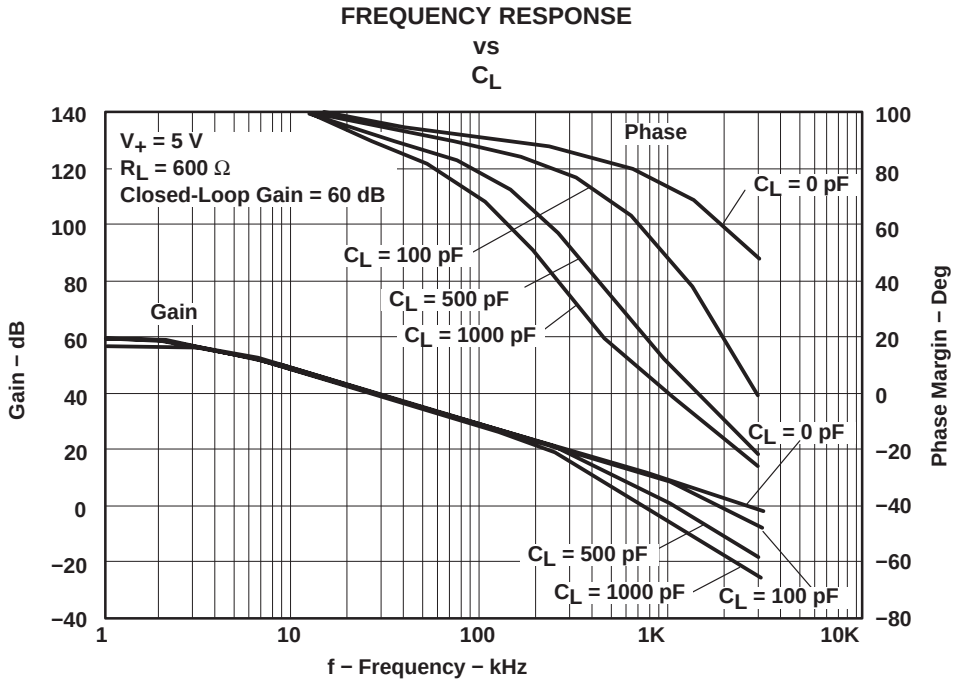


Figure 24

TYPICAL PERFORMANCE CHARACTERISTICS

SMALL-SIGNAL NONINVERTING RESPONSE

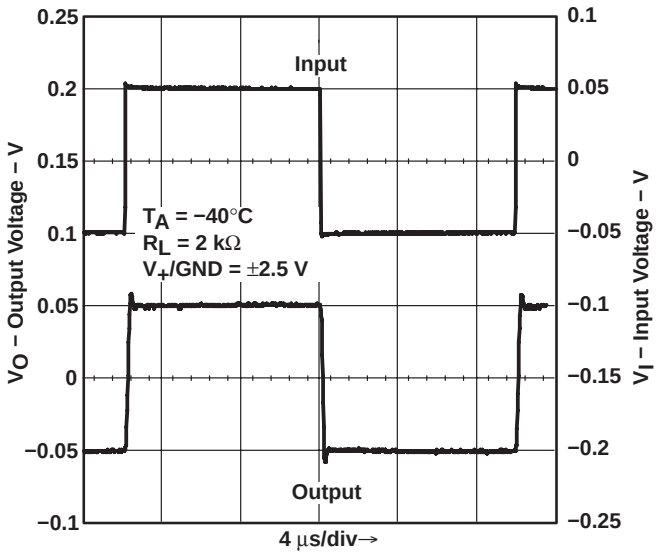


Figure 25

LARGE-SIGNAL NONINVERTING RESPONSE

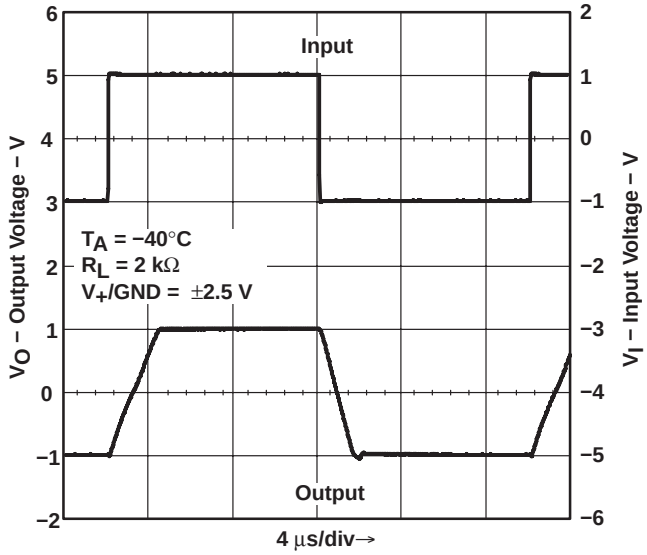


Figure 26

SMALL-SIGNAL NONINVERTING RESPONSE

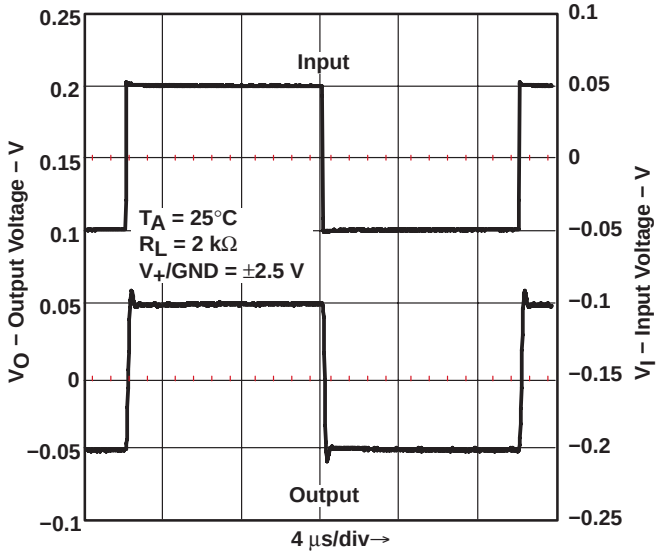


Figure 27

LARGE-SIGNAL NONINVERTING RESPONSE

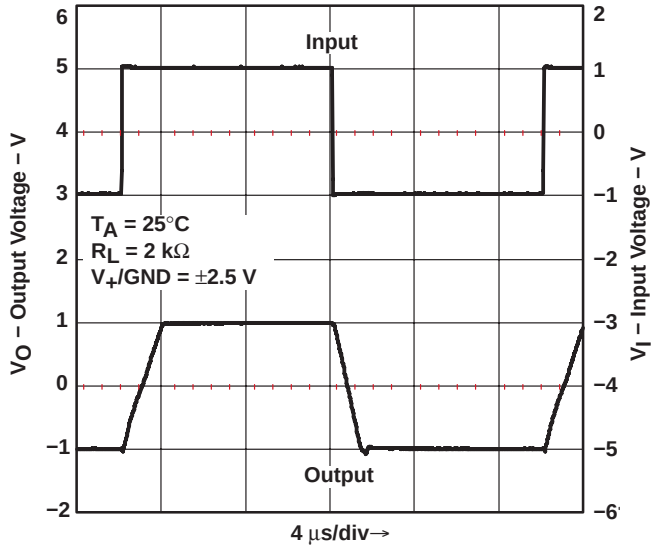


Figure 28

TYPICAL PERFORMANCE CHARACTERISTICS

SMALL-SIGNAL NONINVERTING RESPONSE

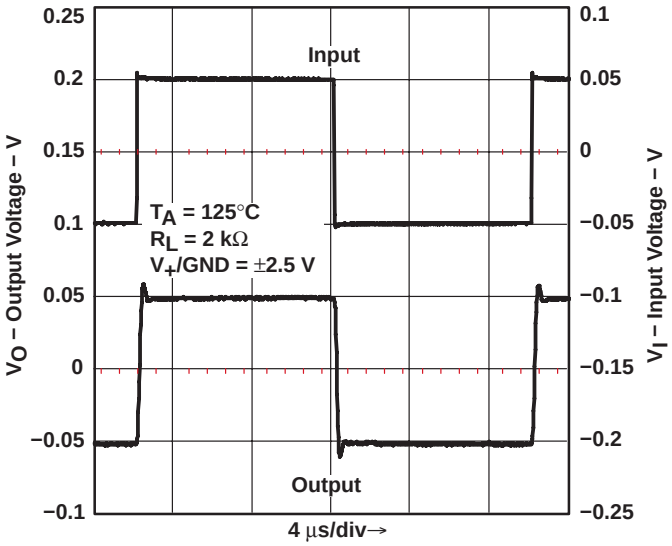


Figure 29

LARGE-SIGNAL NONINVERTING RESPONSE

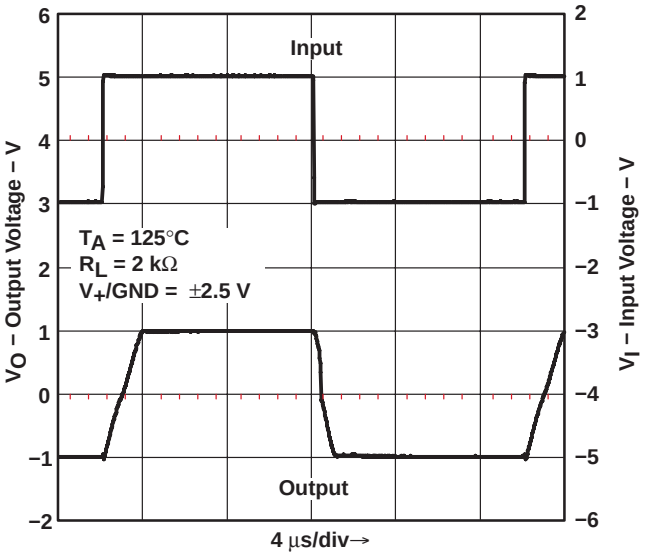


Figure 30

SMALL-SIGNAL INVERTING RESPONSE

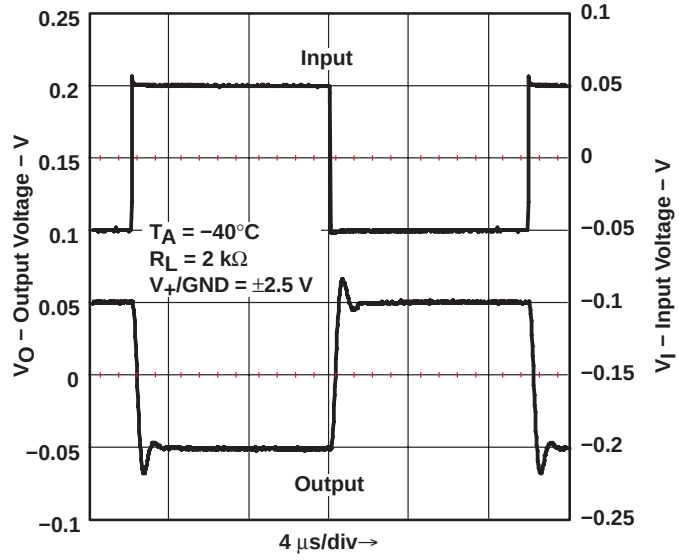


Figure 31

LARGE-SIGNAL INVERTING RESPONSE

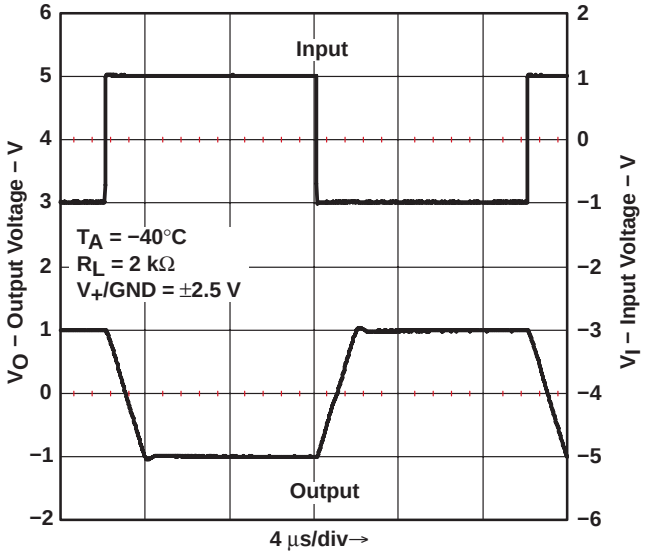


Figure 32

TYPICAL PERFORMANCE CHARACTERISTICS

SMALL-SIGNAL INVERTING RESPONSE

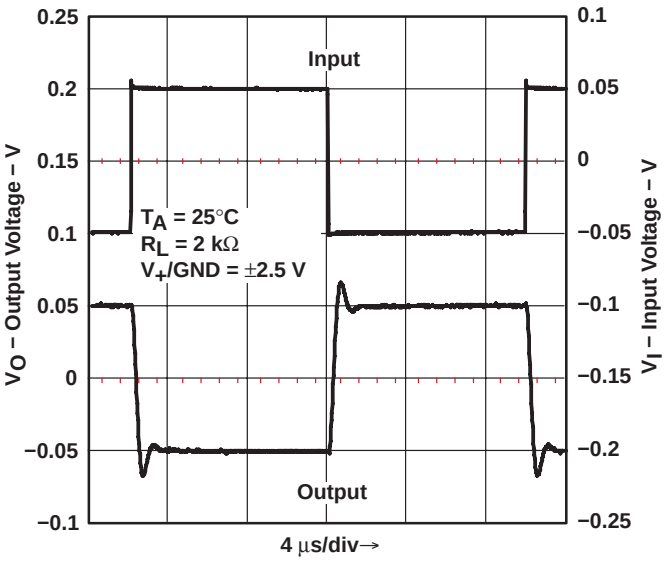


Figure 33

LARGE-SIGNAL INVERTING RESPONSE

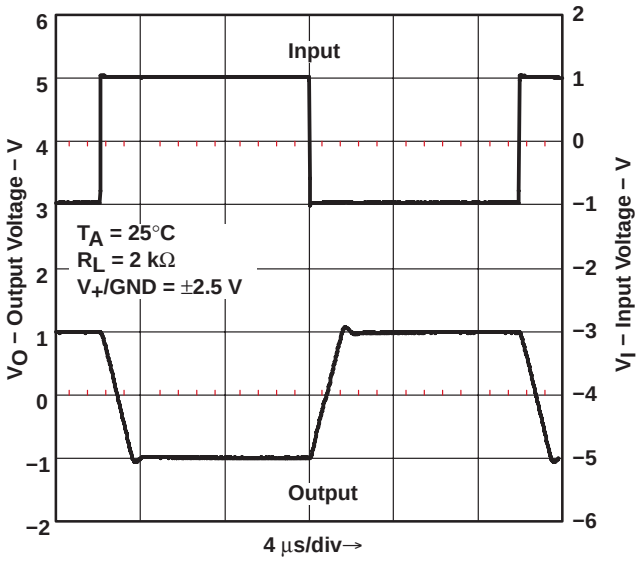


Figure 34

SMALL-SIGNAL INVERTING RESPONSE

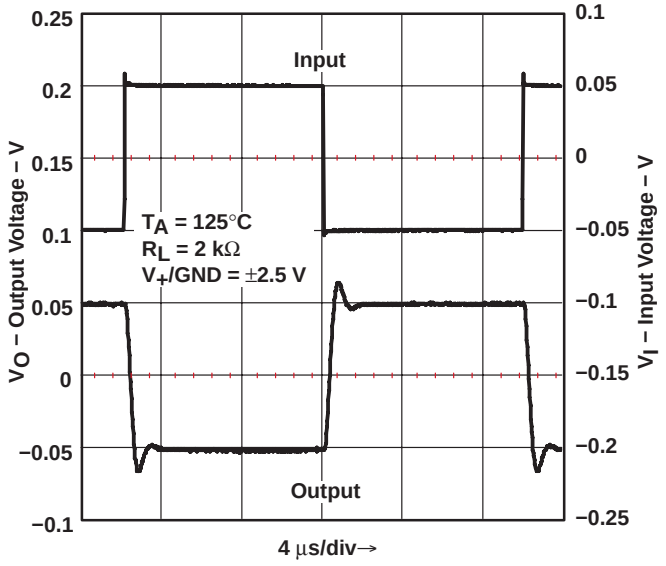


Figure 35

LARGE-SIGNAL INVERTING RESPONSE

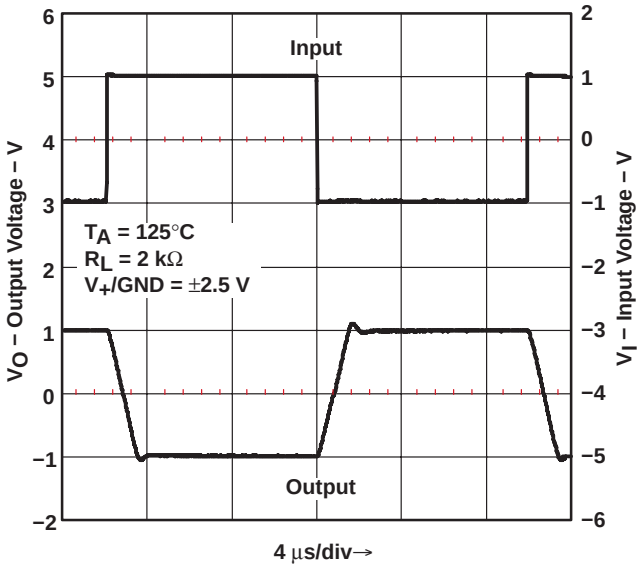
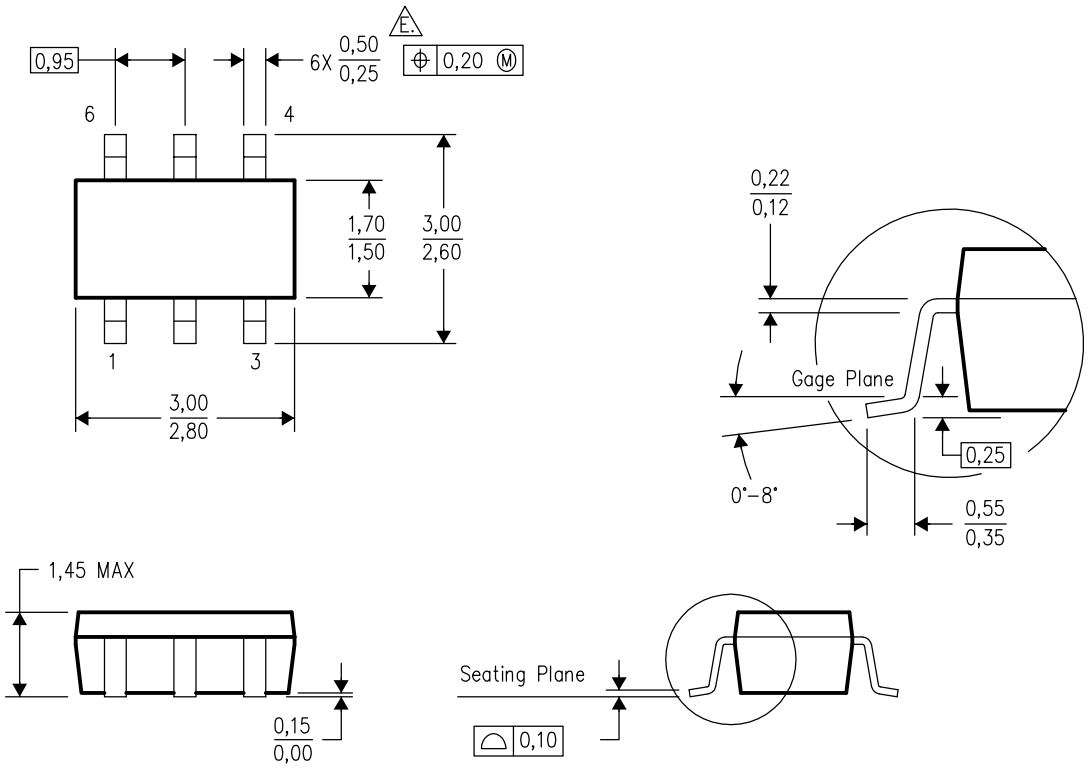


Figure 36

DBV (R–PDSO–G6) PLASTIC SMALL–OUTLINE PACKAGE



4073253–5/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. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
E. Falls within JEDEC MO–178 Variation AB, except minimum lead width.

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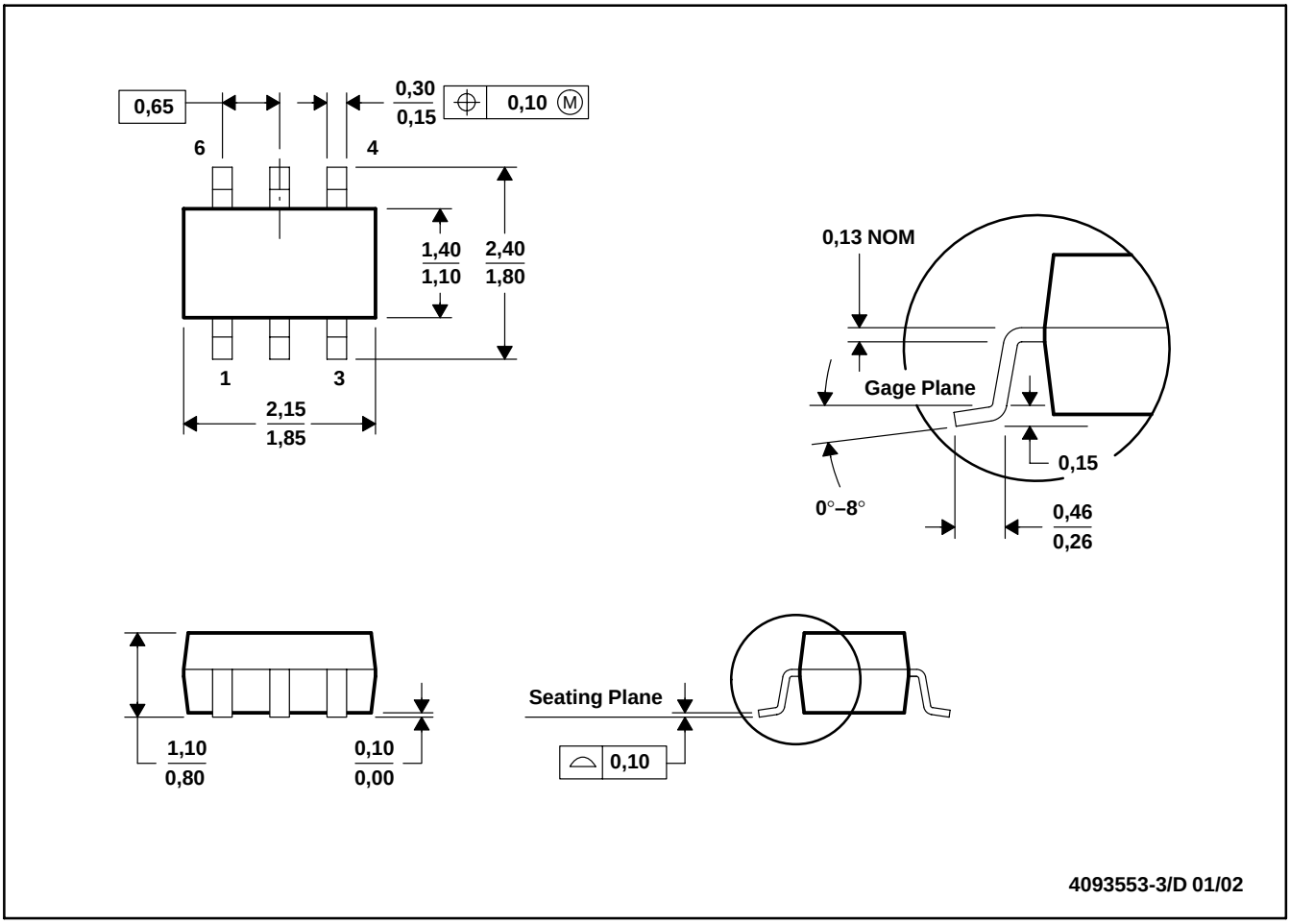
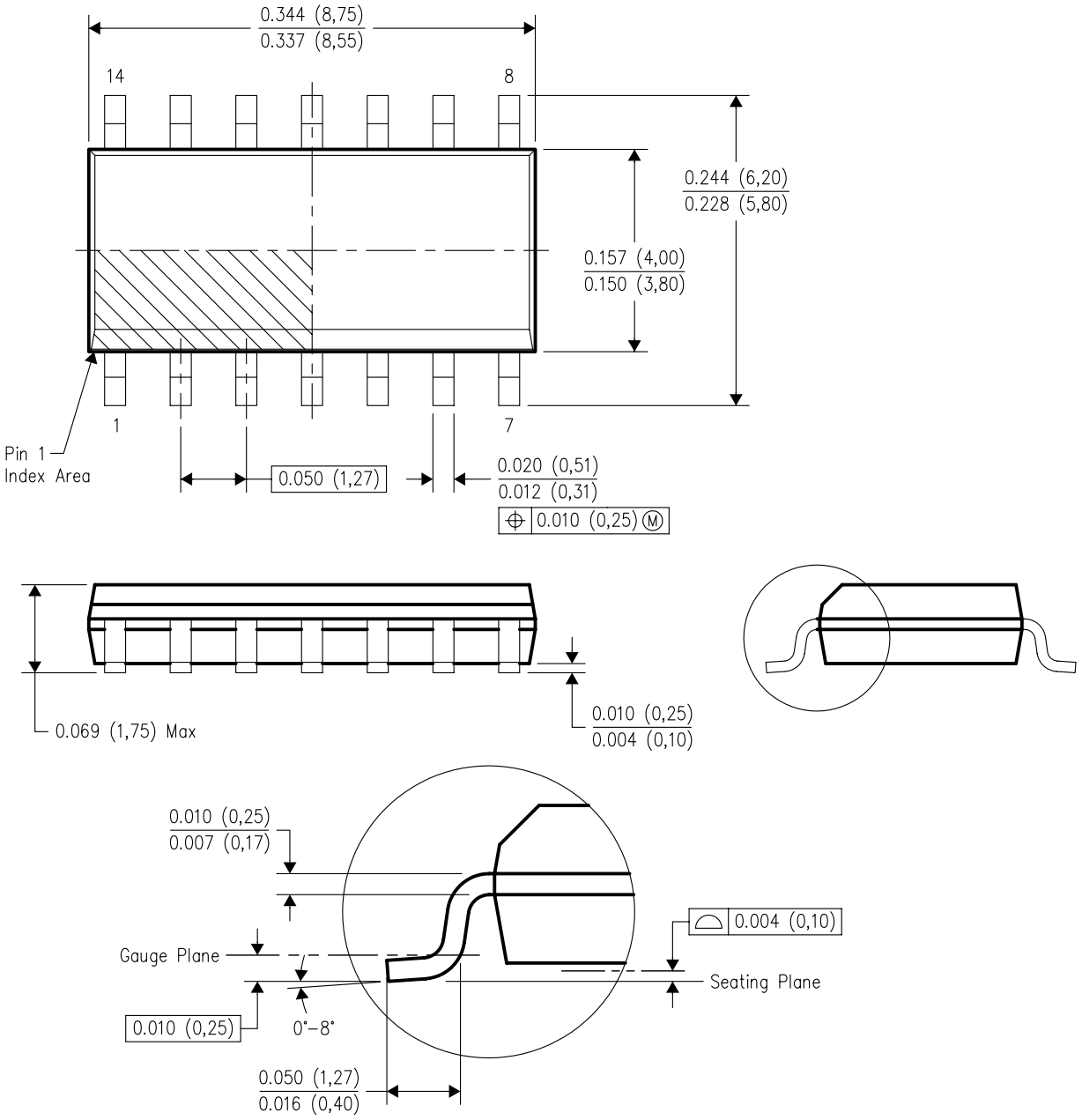
DCK (R-PDSO-G6) **PLASTIC SMALL-OUTLINE PACKAGE**



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

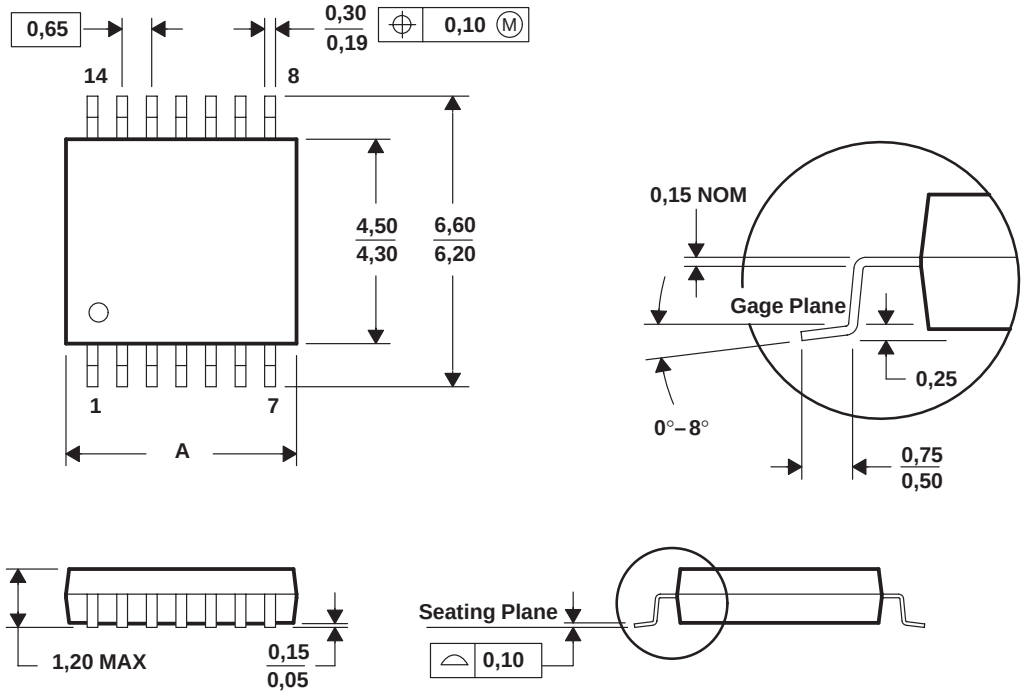
D (R–PDSO–G14) PLASTIC SMALL–OUTLINE PACKAGE



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



DIM \ PINS **	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

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