

LM6152/LM6154 Dual and Quad 75 MHz GBW Rail-to-Rail I/O Operational Amplifiers

Check for Samples: [LM6152](#), [LM6154](#)

FEATURES

- At $V_S = 5V$, typical unless noted.
- Greater than rail-to-rail input CMVR $-0.25V$ to $5.25V$
- Rail-to-rail output swing $0.01V$ to $4.99V$
- Wide gain-bandwidth $75\text{ MHz @ }100\text{ kHz}$
- Slew rate
 - Small signal $5\text{ V}/\mu\text{s}$
 - Large signal $45\text{ V}/\mu\text{s}$
- Low supply current 1.4 mA/amplifier
- Wide supply range $2.7V$ to $24V$
- Fast settling time of $1.1\ \mu\text{s}$ for $2V$ step (to 0.01%)
- PSRR 91 dB
- CMRR 84 dB

APPLICATIONS

- Portable high speed instrumentation
- Signal conditioning amplifier/ADC buffers
- Barcode scanners

DESCRIPTION

Using patented circuit topologies, the LM6152/LM6154 provides new levels of speed vs. power performance in applications where low voltage supplies or power limitations previously made compromise necessary. With only 1.4 mA/amplifier supply current, the 75 MHz gain bandwidth of this device supports new portable applications where higher power devices unacceptably drain battery life. The slew rate of the devices increases with increasing input differential voltage, thus allowing the device to handle capacitive loads while maintaining large signal amplitude.

The LM6152/LM6154 can be driven by voltages that exceed both power supply rails, thus eliminating concerns about exceeding the common-mode voltage range. The rail-to-rail output swing capability provides the maximum possible dynamic range at the output. This is particularly important when operating on low supply voltages.

Operating on supplies from $2.7V$ to over $24V$, the LM6152/LM6154 is excellent for a very wide range of applications, from battery operated systems with large bandwidth requirements to high speed instrumentation.

Connection Diagrams

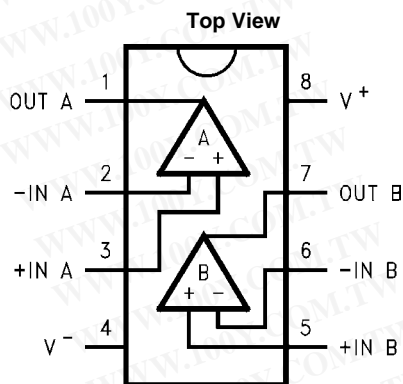


Figure 1. 8-Pin SOIC Package
See Package Number D0008A

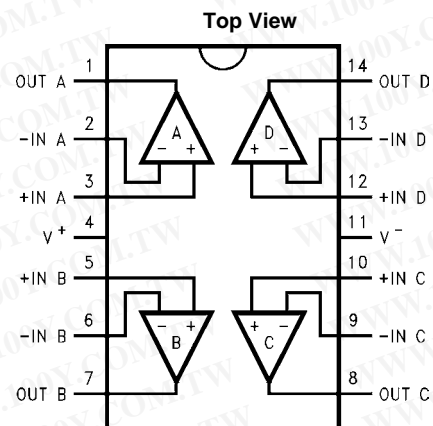


Figure 2. 14-Pin SOIC Package
See Package Number D0014A



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.



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.

All trademarks are the property of their respective owners.

Absolute Maximum Ratings ⁽¹⁾⁽²⁾

ESD Tolerance ⁽³⁾	2500V
Differential Input Voltage	15V
Voltage at Input/Output Pin	(V ⁺) + 0.3V, (V ⁻) -0.3V
Supply Voltage (V ⁺ - V ⁻)	35V
Current at Input Pin	±10 mA
Current at Output Pin ⁽⁴⁾	±25 mA
Current at Power Supply Pin	50 mA
Lead Temperature (soldering, 10 sec)	260°C
Storage Temperature Range	-65°C to +150°C
Junction Temperature ⁽⁵⁾	150°C

- (1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performance is not ensured. For ensured specifications and the test conditions, see the Electrical Characteristics.
- (2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/ Distributors for availability and specifications.
- (3) Human body model is 1.5 kΩ in series with 100 pF.
- (4) 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.
- (5) The maximum power dissipation is a function of T_{J(MAX)}, θ_{JA}, and T_A. The maximum allowable power dissipation at any ambient temperature is P_D = (T_{J(MAX)} - T_A) / θ_{JA}. All numbers apply for packages soldered directly into a PC board.

Operating Ratings ⁽¹⁾

Supply Voltage		2.7V ≤ V ⁺ ≤ 24V
Junction Temperature Range	LM6152, LM6154	0°C ≤ T _J ≤ +70°C
Thermal Resistance (θ _{JA})	8-pin SOIC	193°C/W
	14-pin SOIC	126°C/W

- (1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performance is not ensured. For ensured specifications and the test conditions, see the Electrical Characteristics.

5.0V DC Electrical Characteristics

Unless otherwise specified, all limits are ensured for T_J = 25°C, V⁺ = 5.0V, V⁻ = 0V, V_{CM} = V_O = V⁺/2 and R_L > 1 MΩ to V⁺/2.

Boldface limits apply at the temperature extremes.

Parameter		Test Conditions	Typ ⁽¹⁾	LM6152AC Limit ⁽²⁾	LM6154BC LM6152BC Limit ⁽²⁾	Units
V _{OS}	Input Offset Voltage		0.54	2 4	5 7	mV max
TCV _{OS}	Input Offset Voltage Average Drift		10			μV/°C
I _B	Input Bias Current	0V ≤ V _{CM} ≤ 5V	500 750	980 1500	980 1500	nA max
I _{OS}	Input Offset Current		32 40	100 160	100 160	nA max
R _{IN}	Input Resistance, CM	0V ≤ V _{CM} ≤ 4V	30			MΩ
CMRR	Common Mode Rejection Ratio	0V ≤ V _{CM} ≤ 4V	94	70	70	dB min
		0V ≤ V _{CM} ≤ 5V	84	60	60	
PSRR	Power Supply Rejection Ratio	5V ≤ V ⁺ ≤ 24V	91	80	80	dB min
V _{CM}	Input Common-Mode Voltage Range	Low	-0.25	0	0	V
		High	5.25	5.0	5.0	V
A _V	Large Signal Voltage Gain	R _L = 10 kΩ	214	50	50	V/mV min

(1) Typical Values represent the most likely parametric norm.

(2) All limits are specified by testing or statistical analysis.

5.0V DC Electrical Characteristics (continued)

Unless otherwise specified, all limits are ensured for $T_J = 25^\circ\text{C}$, $V^+ = 5.0\text{V}$, $V^- = 0\text{V}$, $V_{\text{CM}} = V_O = V^+/2$ and $R_L > 1\text{ M}\Omega$ to $V^+/2$. **Boldface** limits apply at the temperature extremes.

Parameter		Test Conditions	Typ ⁽¹⁾	LM6152AC Limit ⁽²⁾	LM6154BC LM6152BC Limit ⁽²⁾	Units
V_O	Output Swing	$R_L = 100\text{ k}\Omega$	0.006	0.02 0.03	0.02 0.03	V max
			4.992	4.97 4.96	4.97 4.96	V min
		$R_L = 2\text{ k}\Omega$	0.04	0.10 0.12	0.10 0.12	V max
			4.89	4.80 4.70	4.80 4.70	V min
I_{SC}	Output Short Circuit Current	Sourcing	6.2	3 2.5	3 2.5	mA min
				27 17	27 17	mA max
		Sinking	16.9	7 5	7 5	mA min
				40	40	mA max
I_S	Supply Current	Per Amplifier	1.4	2 2.25	2 2.25	mA max

5.0V AC Electrical Characteristics

Unless otherwise specified, all limits are ensured for $T_J = 25^\circ\text{C}$, $V^+ = 5.0\text{V}$, $V^- = 0\text{V}$, $V_{\text{CM}} = V_O = V^+/2$ and $R_L > 1\text{ M}\Omega$ to $V^+/2$. **Boldface** limits apply at the temperature extremes.

Parameter		Test Conditions	Typ ⁽¹⁾	LM6152AC Limit ⁽²⁾	LM6154BC LM6152BC Limit ⁽²⁾	Units
SR	Slew Rate	$\pm 4\text{V Step @ } V_S = \pm 6\text{V}$, $R_S < 1\text{ k}\Omega$	30	24 15	24 15	V/ μs min
GBW	Gain-Bandwidth Product	$f = 100\text{ kHz}$	75			MHz
	Amp-to-Amp Isolation	$R_L = 10\text{ k}\Omega$	125			dB
e_n	Input-Referred Voltage Noise	$f = 1\text{ kHz}$	9			nV/ $\sqrt{\text{Hz}}$
i_n	Input-Referred Current Noise	$f = 1\text{ kHz}$	0.34			pA/ $\sqrt{\text{Hz}}$
T.H.D	Total Harmonic Distortion	$f = 100\text{ kHz}$, $R_L = 10\text{ k}\Omega$ $A_V = -1$, $V_O = 2.5 V_{\text{PP}}$	-65			dBc
t_s	Settling Time	2V Step to 0.01%	1.1			μs

(1) Typical Values represent the most likely parametric norm.

(2) All limits are specified by testing or statistical analysis.

2.7V DC Electrical Characteristics

Unless otherwise specified, all limits are ensured for $T_J = 25^\circ\text{C}$, $V^+ = 2.7\text{V}$, $V^- = 0\text{V}$, $V_{\text{CM}} = V_O = V^+/2$ and $R_L > 1\text{ M}\Omega$ to $V^+/2$. **Boldface** limits apply at the temperature extremes.

Parameter		Test Conditions	Typ ⁽¹⁾	LM6152AC Limit ⁽²⁾	LM6154BC LM6152BC Limit ⁽²⁾	Units
V_{OS}	Input Offset Voltage		0.8	2 5	5 8	mV max
TCV_{OS}	Input Offset Voltage Average Drift		10			$\mu\text{V}/^\circ\text{C}$
I_{B}	Input Bias Current		500			nA
I_{OS}	Input Offset Current		50			nA
R_{IN}	Input Resistance, CM	$0\text{V} \leq V_{\text{CM}} \leq 1.8\text{V}$	30			$\text{M}\Omega$
CMRR	Common Mode Rejection Ratio	$0\text{V} \leq V_{\text{CM}} \leq 1.8\text{V}$	88			dB
		$0\text{V} \leq V_{\text{CM}} \leq 2.7\text{V}$	78			
PSRR	Power Supply Rejection Ratio	$3\text{V} \leq V^+ \leq 5\text{V}$	69			dB
V_{CM}	Input Common-Mode Voltage Range	Low	-0.25	0	0	V
		High	2.95	2.7	2.7	V
A_{V}	Large Signal Voltage Gain	$R_L = 10\text{ k}\Omega$	5.5			V/mV
V_O	Output Swing	$R_L = 10\text{ k}\Omega$	0.032	0.07 0.11	0.07 0.11	V max
			2.68	2.64 2.62	2.64 2.62	V min
I_{S}	Supply Current	Per Amplifier	1.35			mA

(1) Typical Values represent the most likely parametric norm.

(2) All limits are specified by testing or statistical analysis.

2.7V AC Electrical Characteristics

Unless otherwise specified, all limits are ensured for $T_J = 25^\circ\text{C}$, $V^+ = 2.7\text{V}$, $V^- = 0\text{V}$, $V_{\text{CM}} = V_O = V^+/2$ and $R_L > 1\text{ M}\Omega$ to $V^+/2$. **Boldface** limits apply at the temperature extremes.

Parameter		Test Conditions	Typ ⁽¹⁾	LM6152AC Limit ⁽²⁾	LM6154BC LM6152BC Limit ⁽²⁾	Units
GBW	Gain-Bandwidth Product	$f = 100\text{ kHz}$	80			MHz

(1) Typical Values represent the most likely parametric norm.

(2) All limits are specified by testing or statistical analysis.

24V DC Electrical Characteristics

Unless otherwise specified, all limits are ensured for $T_J = 25^\circ\text{C}$, $V^+ = 24\text{V}$, $V^- = 0\text{V}$, $V_{\text{CM}} = V_O = V^+/2$ and $R_L > 1\text{M}\Omega$ to $V^+/2$.

Boldface limits apply at the temperature extremes.

Parameter		Test Conditions	Typ ⁽¹⁾	LM6152AC Limit ⁽²⁾	LM6154BC LM6152BC Limit ⁽²⁾	Units
V_{OS}	Input Offset Voltage		0.3	2 4	7 9	mV max
TCV_{OS}	Input Offset Voltage Average Drift		10			$\mu\text{V}/^\circ\text{C}$
I_{B}	Input Bias Current		500			nA
I_{OS}	Input Offset Current		32			nA
R_{IN}	Input Resistance, CM	$0\text{V} \leq V_{\text{CM}} \leq 23\text{V}$	60			Meg Ω
CMRR	Common Mode Rejection Ratio	$0\text{V} \leq V_{\text{CM}} \leq 23\text{V}$	94			dB
		$0\text{V} \leq V_{\text{CM}} \leq 24\text{V}$	84			
PSRR	Power Supply Rejection Ratio	$0\text{V} \leq V_{\text{CM}} \leq 24\text{V}$	95			dB
V_{CM}	Input Common-Mode Voltage Range	Low	-0.25	0	0	V
		High	24.25	24	24	V
A_V	Large Signal Voltage Gain	$R_L = 10\text{ k}\Omega$	55			V/mV
V_O	Output Swing	$R_L = 10\text{ k}\Omega$	0.044	0.075 0.090	0.075 0.090	V max
			23.91	23.8 23.7	23.8 23.7	V min
I_{S}	Supply Current	Per Amplifier	1.6	2.25 2.50	2.25 2.50	mA max

(1) Typical Values represent the most likely parametric norm.

(2) All limits are specified by testing or statistical analysis.

24V AC Electrical Characteristics

Unless otherwise specified, all limits are ensured for $T_J = 25^\circ\text{C}$, $V^+ = 24\text{V}$, $V^- = 0\text{V}$, $V_{\text{CM}} = V_O = V^+/2$ and $R_L > 1\text{M}\Omega$ to $V^+/2$.

Boldface limits apply at the temperature extremes.

Parameter		Test Conditions	Typ ⁽¹⁾	LM6152AC Limit ⁽²⁾	LM6154BC LM6152BC Limit ⁽²⁾	Units
GBW	Gain-Bandwidth Product	$f = 100\text{ kHz}$	80			MHz

(1) Typical Values represent the most likely parametric norm.

(2) All limits are specified by testing or statistical analysis.

Typical Performance Characteristics

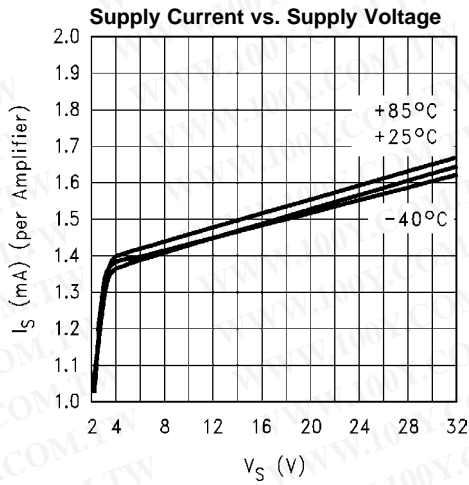


Figure 3.

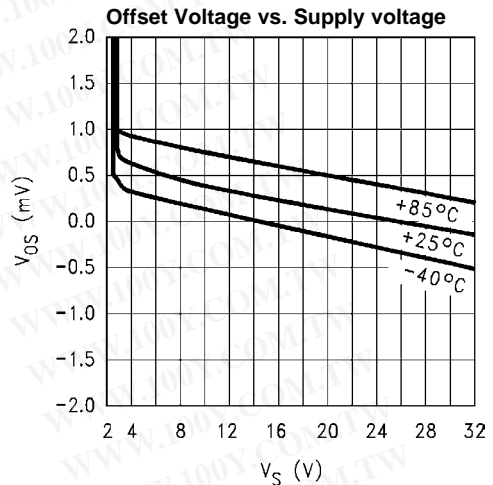


Figure 4.

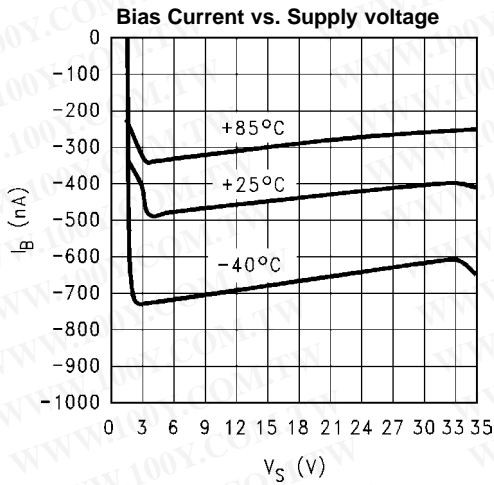


Figure 5.

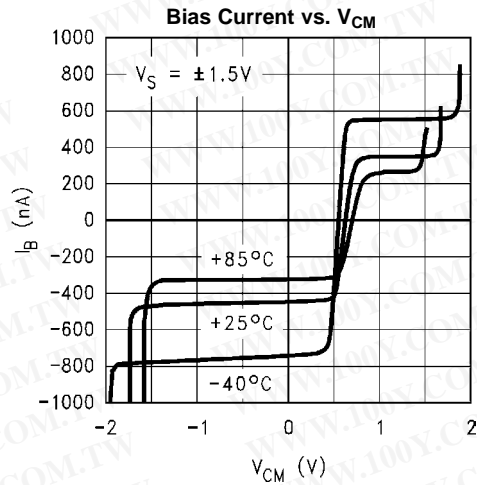


Figure 6.

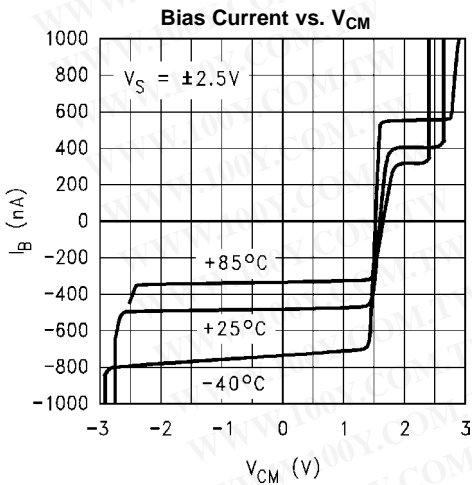


Figure 7.

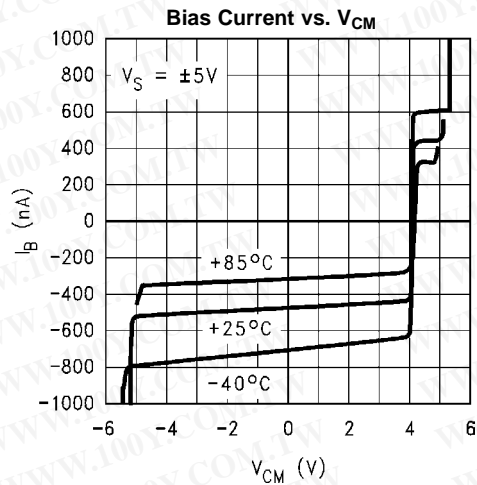


Figure 8.

Typical Performance Characteristics (continued)

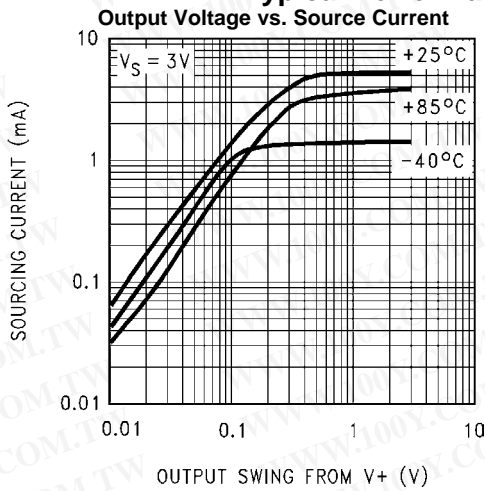


Figure 9.

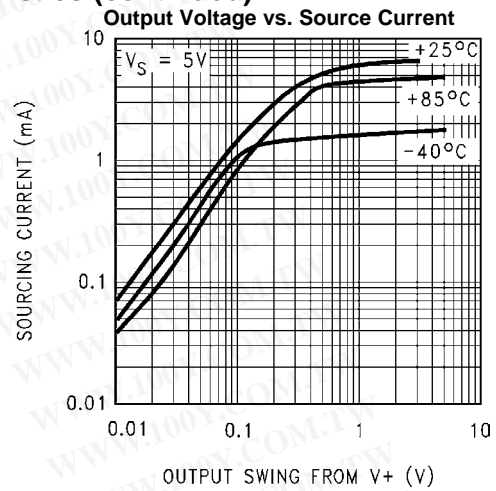


Figure 10.

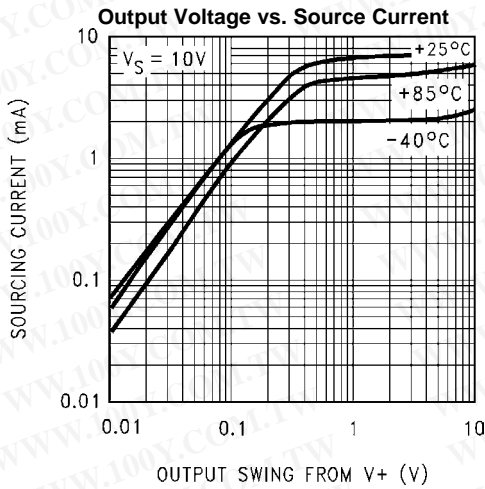


Figure 11.

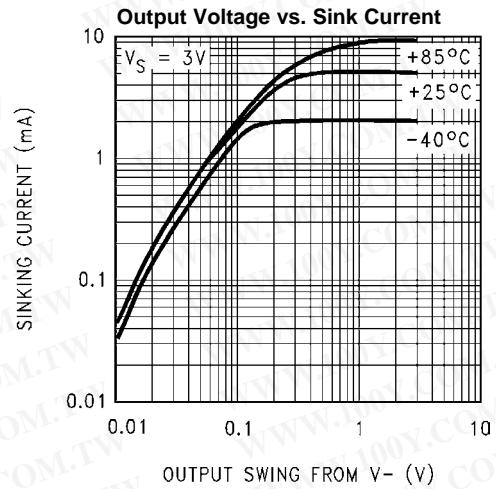


Figure 12.

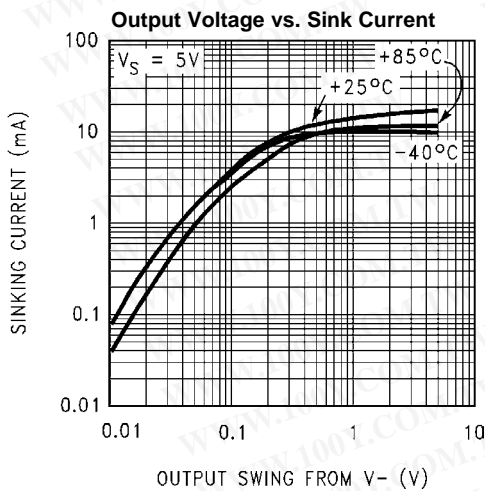


Figure 13.

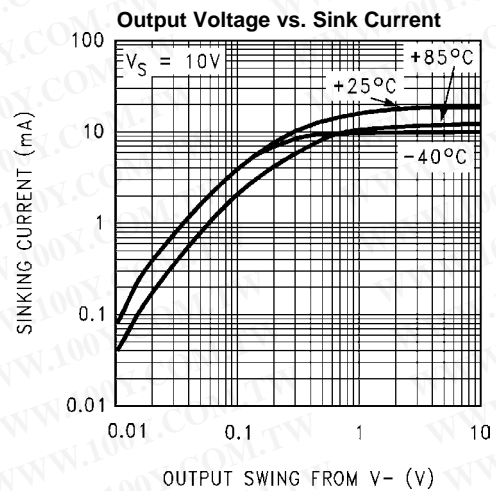
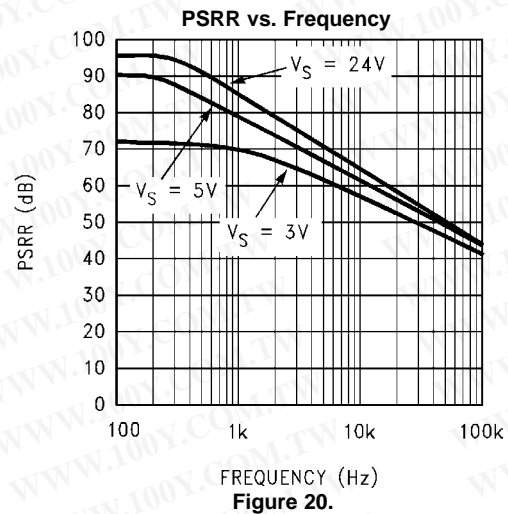
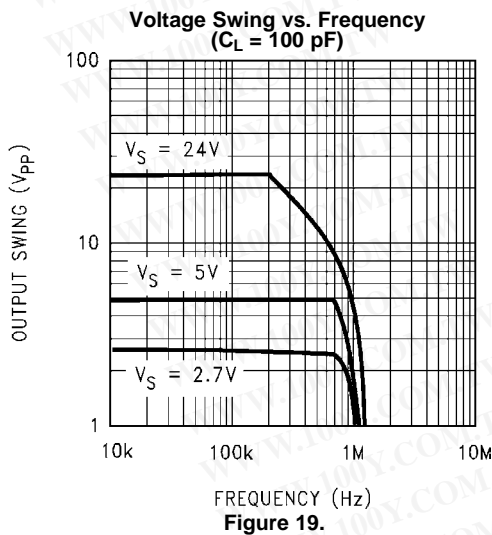
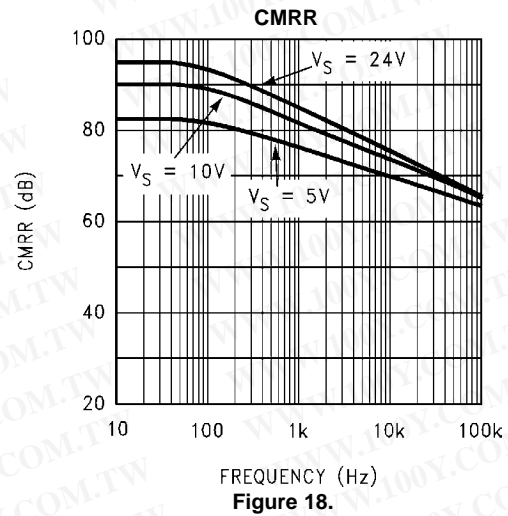
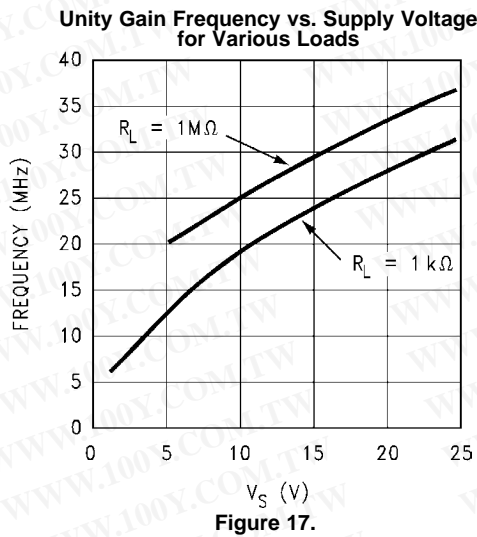
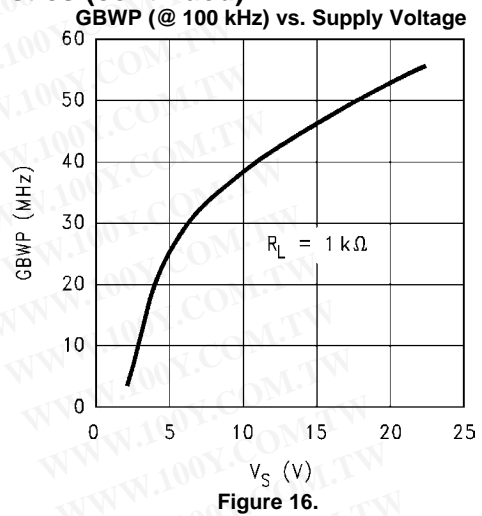
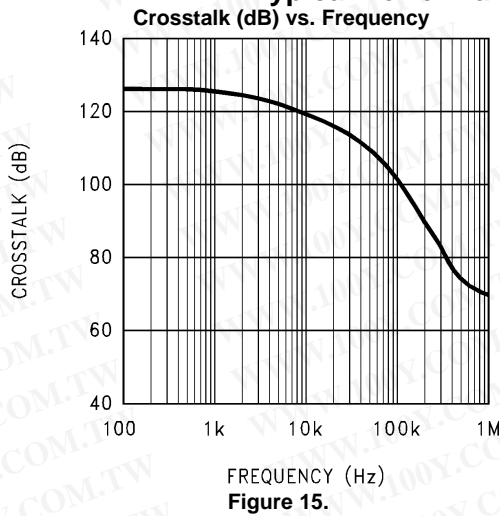


Figure 14.

Typical Performance Characteristics (continued)



Typical Performance Characteristics (continued)

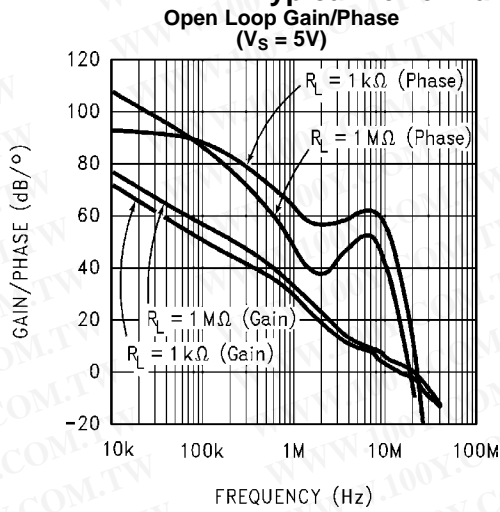


Figure 21.

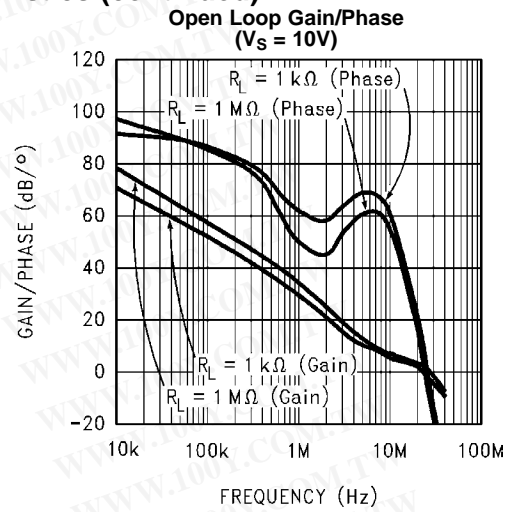


Figure 22.

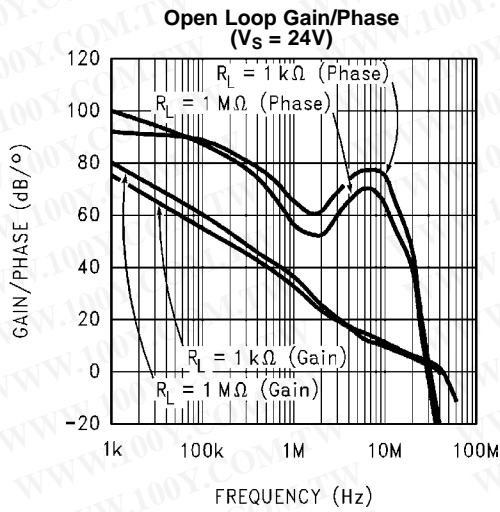


Figure 23.

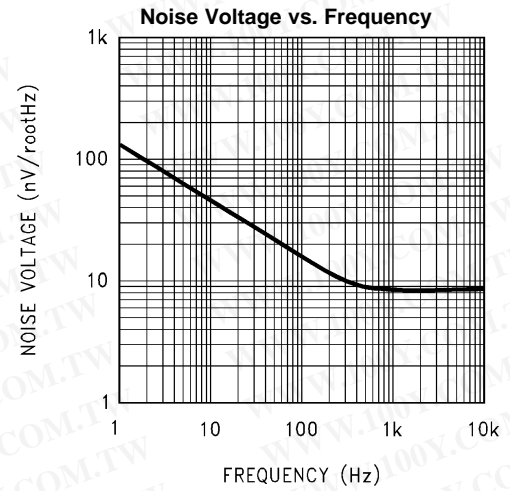


Figure 24.

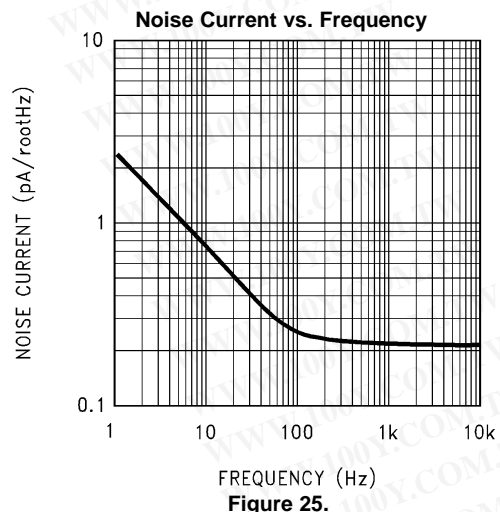


Figure 25.

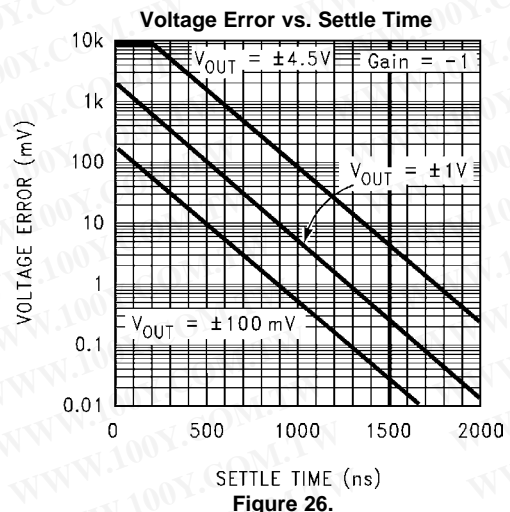


Figure 26.

Typical Performance Characteristics (continued)
Distortion vs. Frequency

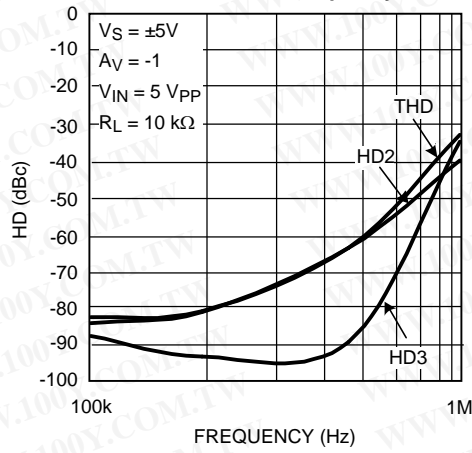


Figure 27.

APPLICATION INFORMATION

The LM6152/LM6154 is ideally suited for operation with about 10 kΩ (Feedback Resistor, R_F) between the output and the negative input terminal.

With R_F set to this value, for most applications requiring a close loop gain of 10 or less, an additional small compensation capacitor (C_F) (see Figure 28) is recommended across R_F in order to achieve a reasonable overshoot (10%) at the output by compensating for stray capacitance across the inputs.

The optimum value for C_F can best be established experimentally with a trimmer cap in place since its value is dependant on the supply voltage, output driving load, and the operating gain. Below, some typical values used in an inverting configuration and driving a 10 kΩ load have been tabulated for reference:

Table 1. Typical BW (–3 dB) at Various Supply Voltage and Gains

V_s Volts	Gain	C_F pF	BW (–3 dB) MHz
3	–1	5.6	4
	–10	6.8	1.97
	–100	None	0.797
24	–1	2.2	6.6
	–10	4.7	2.2
	–100	None	0.962

In the non-inverting configuration, the LM6152/LM6154 can be used for closed loop gains of +2 and above. In this case, also, the compensation capacitor (C_F) is recommended across R_F (= 10 kΩ) for gains of 10 or less.

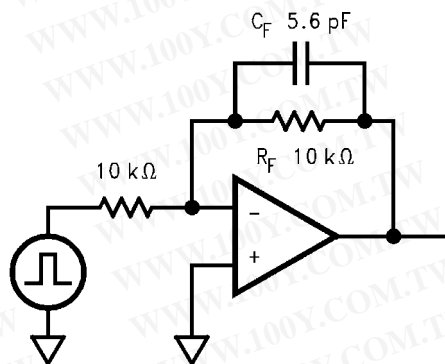


Figure 28. Typical Inverting Gain Circuit $A_V = -1$

Because of the unique structure of this amplifier, when used at low closed loop gains, the realizable BW will be much less than the GBW product would suggest.

The LM6152/LM6154 brings a new level of ease of use to op amp system design.

The greater than rail-to-rail input voltage range eliminates concern over exceeding the common-mode voltage range. The rail-to-rail output swing provides the maximum possible dynamic range at the output. This is particularly important when operating on low supply voltages.

The high gain-bandwidth with low supply current opens new battery powered applications where higher power consumption previously reduced battery life to unacceptable levels.

The ability to drive large capacitive loads without oscillating functional removes this common problem.

To take advantage of these features, some ideas should be kept in mind.

The LM6152/LM6154, capacitive loads do not lead to oscillations, in all but the most extreme conditions, but they will result in reduced bandwidth. They also cause increased settling time.

Unlike most bipolar op amps, the unique phase reversal prevention/speed-up circuit in the input stage, causes the slew rate to be very much a function of the input pulse amplitude. This results in a 10 to 1 increase in slew rate when the differential input signal increases. Large fast pulses will raise the slew-rate to more than 30 V/ μ s.

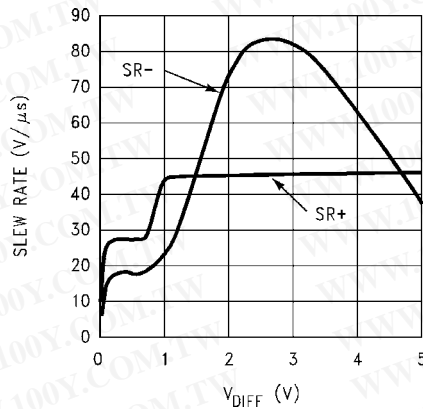


Figure 29. Slew Rate vs. V_{DIFF}

The speed-up action adds stability to the system when driving large capacitive loads.

A conventional op amp exhibits a fixed maximum slew-rate even though the differential input voltage rises due to the lagging output voltage. In the LM6152/LM6154, increasing lag causes the differential input voltage to increase but as it does, the increased slew-rate keeps the output following the input much better. This effectively reduces phase lag. As a result, the LM6152/LM6154 can drive capacitive loads as large as 470 pF at gain of 2 and above, and not oscillate.

Capacitive loads decrease the phase margin of all op amps. This can lead to overshoot, ringing and oscillation. This is caused by the output resistance of the amplifier and the load capacitance forming an R-C phase shift network. The LM6152/6154 senses this phase shift and partly compensates for this effect.

REVISION HISTORY

Changes from Revision C (March 2013) to Revision D

Page

- Changed layout of National Data Sheet to TI format 12

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LM6152ACM	ACTIVE	SOIC	D	8	95	TBD	Call TI	Call TI	0 to 70	LM61 52ACM	Samples
LM6152ACM/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	LM61 52ACM	Samples
LM6152ACMX	ACTIVE	SOIC	D	8	2500	TBD	Call TI	Call TI	0 to 70	LM61 52ACM	Samples
LM6152ACMX/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	LM61 52ACM	Samples
LM6152BCM	ACTIVE	SOIC	D	8	95	TBD	Call TI	Call TI	0 to 70	LM61 52BCM	Samples
LM6152BCM/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	LM61 52BCM	Samples
LM6152BCMXX	ACTIVE	SOIC	D	8	2500	TBD	Call TI	Call TI	0 to 70	LM61 52BCM	Samples
LM6152BCMXX/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	LM61 52BCM	Samples
LM6154BCM	ACTIVE	SOIC	D	14	55	TBD	Call TI	Call TI	0 to 70	LM6154BCM	Samples
LM6154BCM/NOPB	ACTIVE	SOIC	D	14	55	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	LM6154BCM	Samples
LM6154BCMXX	ACTIVE	SOIC	D	14	2500	TBD	Call TI	Call TI	0 to 70	LM6154BCM	Samples
LM6154BCMXX/NOPB	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	LM6154BCM	Samples

(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 - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

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.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

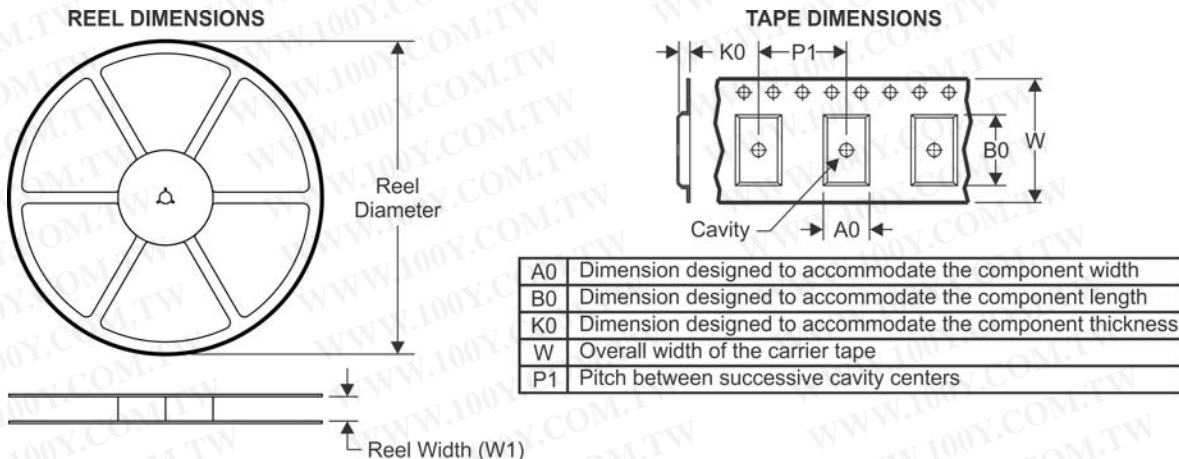
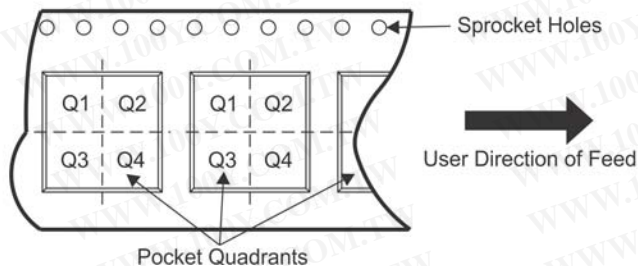
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

⁽⁴⁾ Multiple Top-Side Markings will be inside parentheses. Only one Top-Side Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Top-Side Marking for that device.

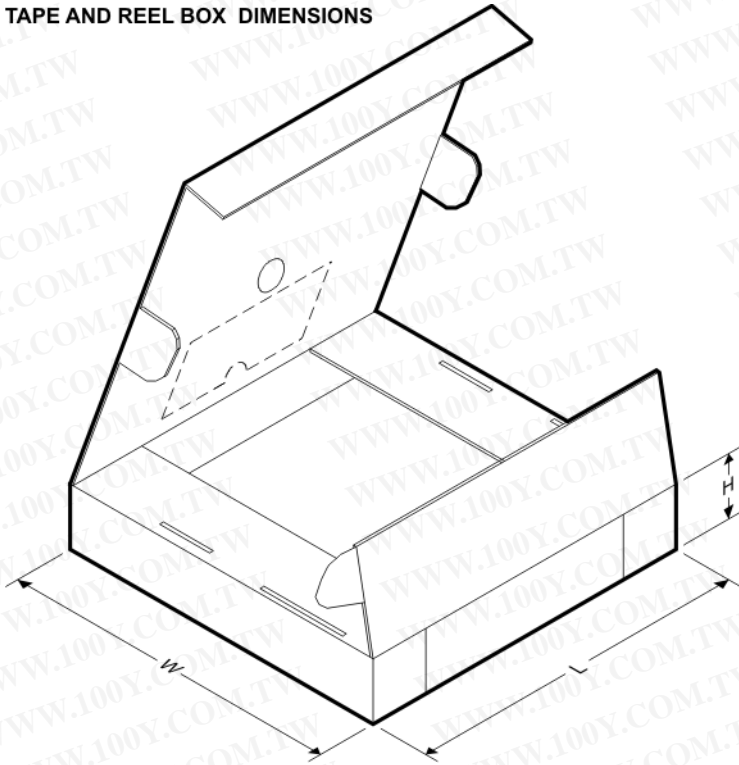
Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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.

TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM6152ACMX	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM6152ACMX/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM6152BCMX	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM6152BCMX/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM6154BCMX	SOIC	D	14	2500	330.0	16.4	6.5	9.35	2.3	8.0	16.0	Q1
LM6154BCMX/NOPB	SOIC	D	14	2500	330.0	16.4	6.5	9.35	2.3	8.0	16.0	Q1

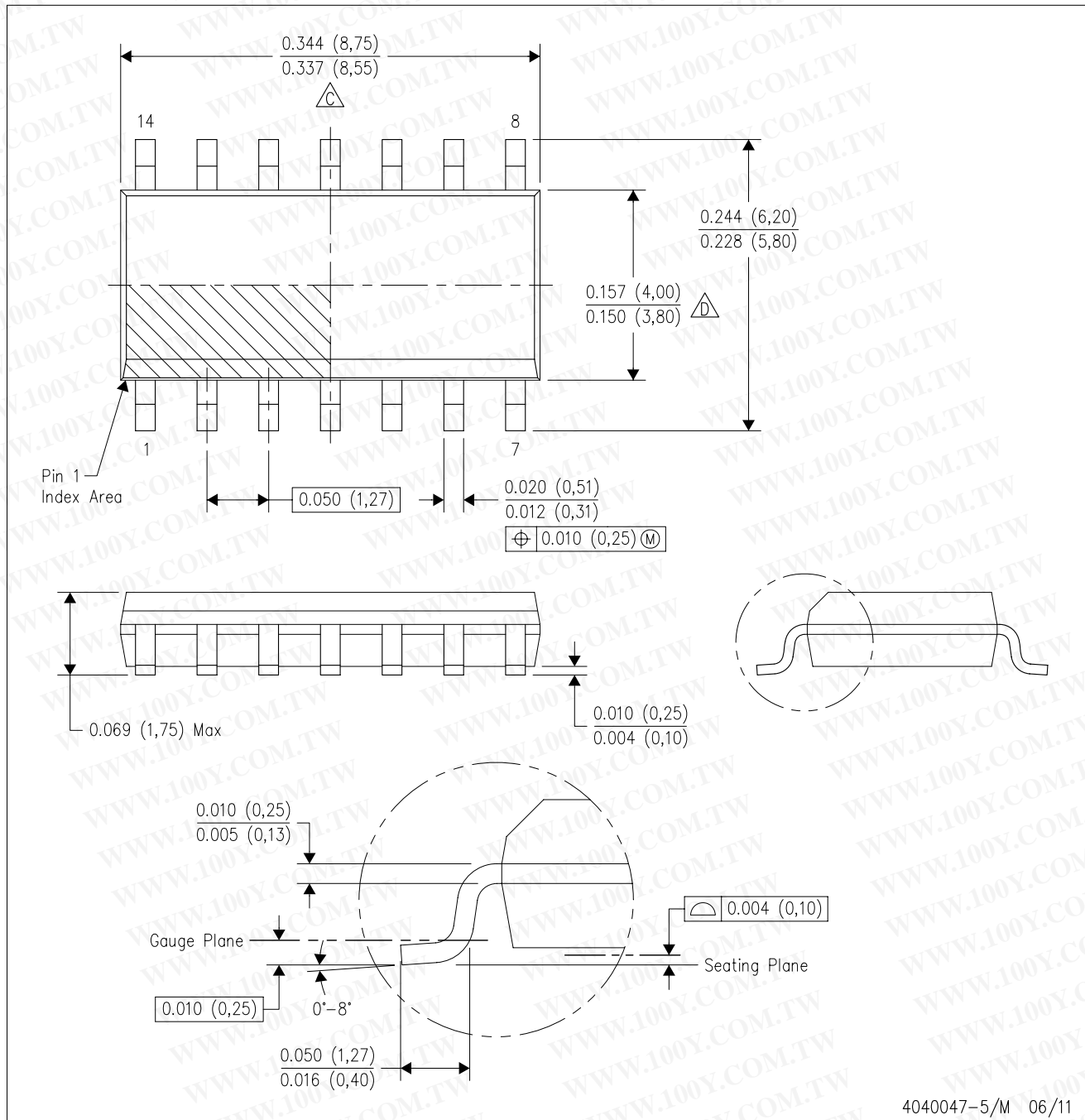
TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM6152ACMX	SOIC	D	8	2500	367.0	367.0	35.0
LM6152ACMX/NOPB	SOIC	D	8	2500	367.0	367.0	35.0
LM6152BCMX	SOIC	D	8	2500	367.0	367.0	35.0
LM6152BCMX/NOPB	SOIC	D	8	2500	367.0	367.0	35.0
LM6154BCMX	SOIC	D	14	2500	367.0	367.0	35.0
LM6154BCMX/NOPB	SOIC	D	14	2500	367.0	367.0	35.0

D (R-PDSO-G14)

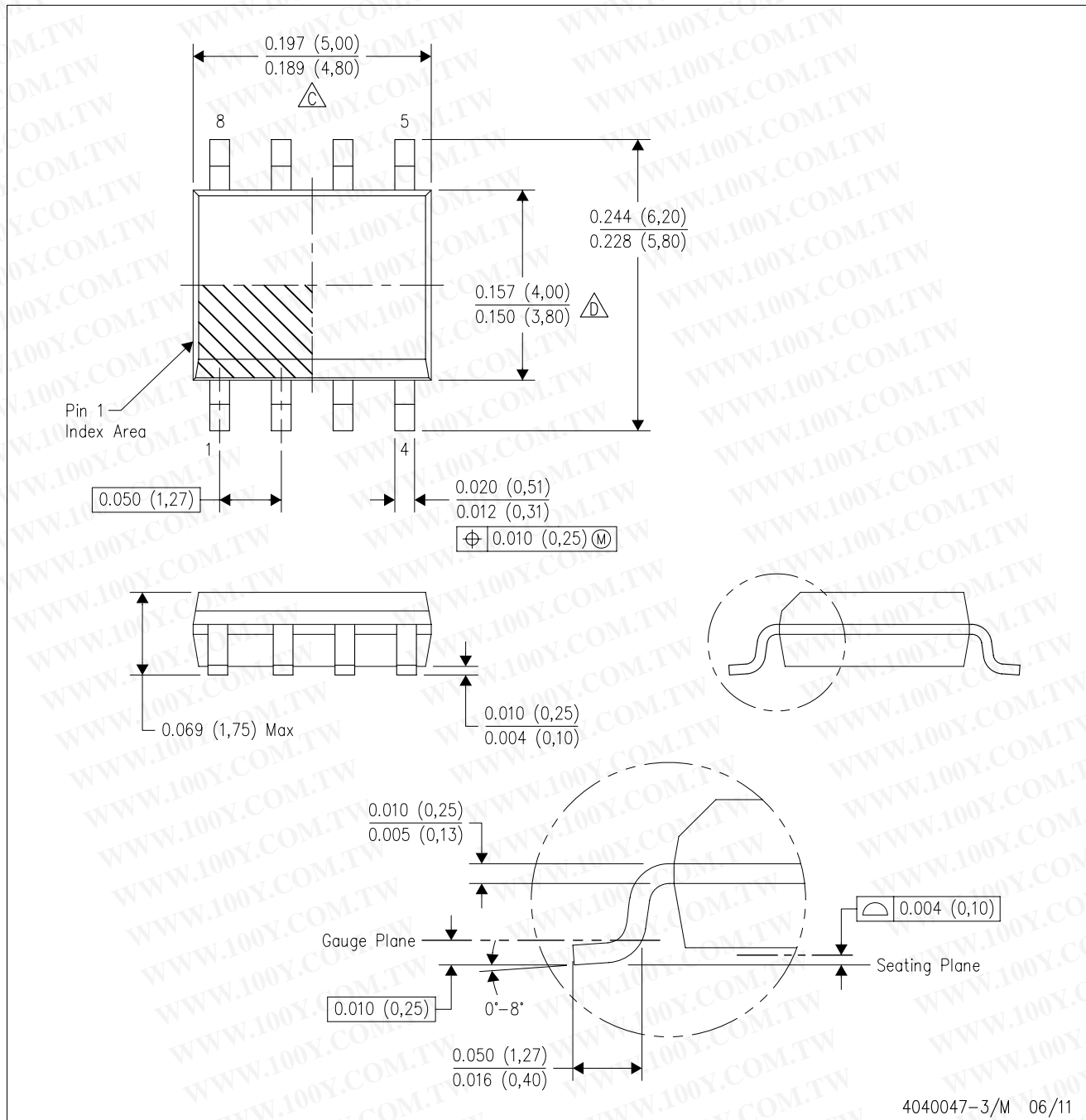
PLASTIC SMALL OUTLINE





- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 - Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AB.

D (R-PDSO-G8)

PLASTIC SMALL OUTLINE



4040047-3/M 06/11

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 -  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 -  Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AA.

勝特力材料 886-3-5753170
勝特力电子(上海) 86-21-34970699
勝特力电子(深圳) 86-755-83298787
Http://www.100y.com.tw

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Applications Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community

e2e.ti.com

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2013, Texas Instruments Incorporated