

LM747

LM747 Dual Operational Amplifier



Literature Number: SNOS661

LM747

Dual Operational Amplifier

General Description

The LM747 is a general purpose dual operational amplifier. The two amplifiers share a common bias network and power supply leads. Otherwise, their operation is completely independent.

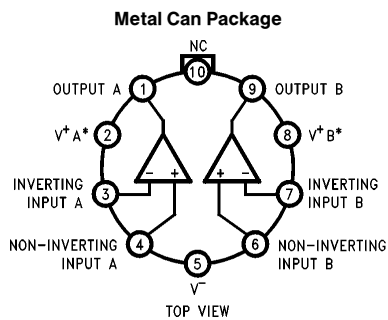
Additional features of the LM747 are: no latch-up when input common mode range is exceeded, freedom from oscillations, and package flexibility.

The LM747C/LM747E is identical to the LM747/LM747A except that the LM747C/LM747E has its specifications guaranteed over the temperature range from 0°C to +70°C instead of -55°C to +125°C.

Features

- No frequency compensation required
- Short-circuit protection
- Wide common-mode and differential voltage ranges
- Low power consumption
- No latch-up
- Balanced offset null

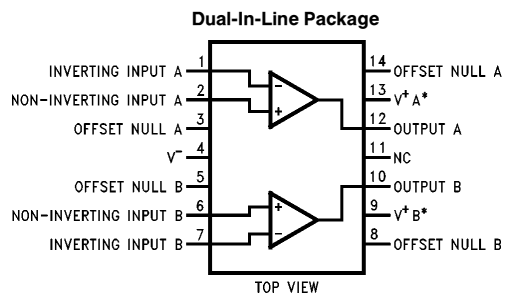
Connection Diagrams



TL/H/11479-4

Order Number LM747H
See NS Package Number H10C

*V⁺A and V⁺B are internally connected.



TL/H/11479-5

Order Number LM747CN or LM747EN
See NS Package Number N14A

Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage	
LM747/LM747A	±22V
LM747C/LM747E	±18V
Power Dissipation (Note 1)	800 mW
Differential Input Voltage	±30V

Input Voltage (Note 2)	±15V
Output Short-Circuit Duration	Indefinite
Operating Temperature Range	
LM747/LM747A	-55°C to +125°C
LM747C/LM747E	0°C to +70°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10 sec.)	300°C

Electrical Characteristics (Note 3)

Parameter	Conditions	LM747A/LM747E			LM747			LM747C			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage	$T_A = 25^\circ\text{C}$ $R_S \leq 10\text{ k}\Omega$ $R_S \leq 50\Omega$		0.8	3.0	1.0	5.0		2.0	6.0		mV
	$R_S \leq 50\Omega$ $R_S \leq 10\text{ k}\Omega$			4.0		6.0			7.5		mV
Average Input Offset Voltage Drift				15							$\mu\text{V}/^\circ\text{C}$
Input Offset Voltage Adjustment Range	$T_A = 25^\circ\text{C}$, $V_S = \pm 20\text{V}$	±10			±15			±15			mV
Input Offset Current	$T_A = 25^\circ\text{C}$		3.0	30	20	200		20	200		nA
				70	85	500			300		nA
Average Input Offset Current Drift				0.5							nA/ $^\circ\text{C}$
Input Bias Current	$T_A = 25^\circ\text{C}$ $T_{\text{AMIN}} \leq T_A \leq T_{\text{AMAX}}$		30	80	80	500		80	500		nA
				0.210		1.5			0.8		μA
Input Resistance	$T_A = 25^\circ\text{C}$, $V_S = \pm 20\text{V}$	1.0	6.0		0.3	2.0		0.3	2.0		M Ω
	$V_S = \pm 20\text{V}$	0.5									M Ω
Input Voltage Range	$T_A = 25^\circ\text{C}$							±12	±13		V
		±12	±13		±12	±13					V
Large Signal Voltage Gain	$T_A = 25^\circ\text{C}$, $R_L \geq 2\text{ k}\Omega$ $V_S = \pm 20\text{V}$, $V_O = \pm 15\text{V}$	50									V/mV
	$V_S = \pm 15\text{V}$, $V_O = \pm 10\text{V}$ $R_L \geq 2\text{ k}\Omega$				50	200		20	200		V/mV
	$V_S = \pm 20\text{V}$, $V_O = \pm 15\text{V}$	32									V/mV
	$V_S = \pm 15\text{V}$, $V_O = \pm 10\text{V}$				25			15			V/mV
	$V_S = \pm 5\text{V}$, $V_O = \pm 2\text{V}$	10									V/mV
Output Voltage Swing	$V_S = \pm 20\text{V}$ $R_L \geq 10\text{ k}\Omega$ $R_L \geq 2\text{ k}\Omega$	±16									V
	$V_S = \pm 15\text{V}$ $R_L \geq 10\text{ k}\Omega$ $R_L \geq 2\text{ k}\Omega$				±12	±14		±12	±14		V
		±10	±13		±10	±13		±10	±13		V
Output Short Circuit Current	$T_A = 25^\circ\text{C}$	10	25	35	25			25			mA
Common-Mode Rejection Ratio	$R_S \leq 10\text{ k}\Omega$, $V_{\text{CM}} = \pm 12\text{V}$				70	90		70	90		dB
	$R_S \leq 50\text{ k}\Omega$, $V_{\text{CM}} = \pm 12\text{V}$	80	95								dB

Electrical Characteristics (Note 3) (Continued)

Parameter	Conditions	LM747A/LM747E			LM747			LM747C			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Supply Voltage Rejection Ratio	$V_S = \pm 20V$ to $V_S = \pm 5V$ $R_S \leq 50\Omega$ $R_S \leq 10\text{ k}\Omega$	86	96		77	96		77	96		dB
Transient Response Rise Time Overshoot	$T_A = 25^\circ\text{C}$, Unity Gain		0.25 6.0	0.8 20		0.3 5			0.3 5		μs %
Bandwidth (Note 4)	$T_A = 25^\circ\text{C}$	0.437	1.5								MHz
Slew Rate	$T_A = 25^\circ\text{C}$, Unity Gain	0.3	0.7		0.5			0.5			$\text{V}/\mu\text{s}$
Supply Current/Amp	$T_A = 25^\circ\text{C}$			2.5	1.7	2.8		1.7	2.8		mA
Power Consumption/Amp	$T_A = 25^\circ\text{C}$ $V_S = \pm 20V$ $V_S = \pm 15V$		80	150		50	85		50	85	mW
LM747A	$V_S = \pm 20V$ $T_A = T_{A\text{MIN}}$ $T_A = T_{A\text{MAX}}$			165 135							mW
LM747E	$V_S = \pm 20V$ $T_A = T_{A\text{MIN}}$ $T_A = T_{A\text{MAX}}$			150 150 150							mW
LM747	$V_S = \pm 15V$ $T_A = T_{A\text{MIN}}$ $T_A = T_{A\text{MAX}}$				60	100		45	75		mW

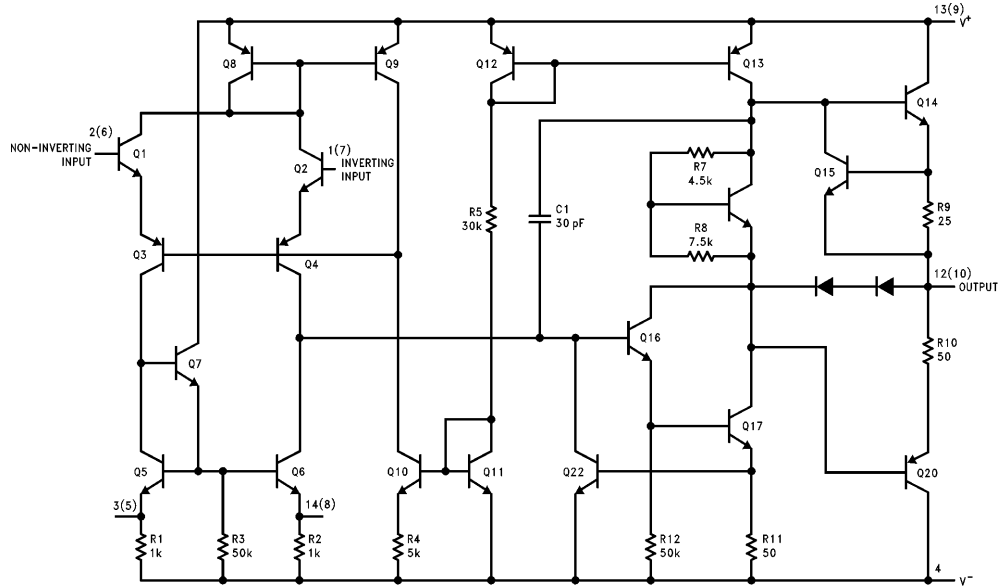
Note 1: The maximum junction temperature of the LM747C/LM747E is 100°C . For operating at elevated temperatures, devices in the TO-5 package must be derated based on a thermal resistance of $150^\circ\text{C}/\text{W}$, junction to ambient, or $45^\circ\text{C}/\text{W}$, junction to case. The thermal resistance of the dual-in-line package is $100^\circ\text{C}/\text{W}$, junction to ambient.

Note 2: For supply voltages less than $\pm 15V$, the absolute maximum input voltage is equal to the supply voltage.

Note 3: These specifications apply for $\pm 5V \leq V_S \leq \pm 20V$ and $-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$ for the LM747A and $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$ for the LM747E unless otherwise specified. The LM747 and LM747C are specified for $V_S = \pm 15V$ and $-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$ and $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$, respectively, unless otherwise specified.

Note 4: Calculated value from: $0.35/\text{Rise Time}$ (μs).

Schematic Diagram (Each Amplifier)

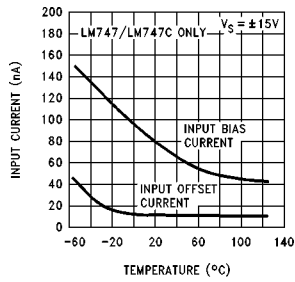


Note: Numbers in parentheses are pin numbers for amplifier B. DIP only.

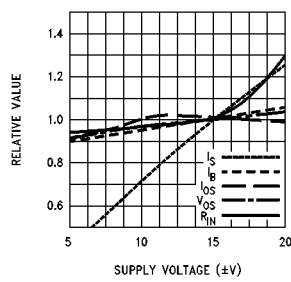
TL/H/11479-1

Typical Performance Characteristics

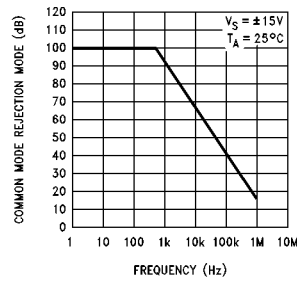
Input Bias and Offset Currents vs Ambient Temperature



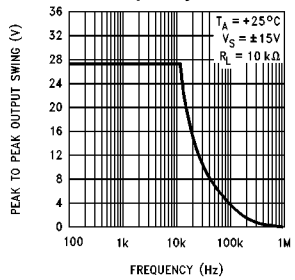
DC Parameters vs Supply Voltage



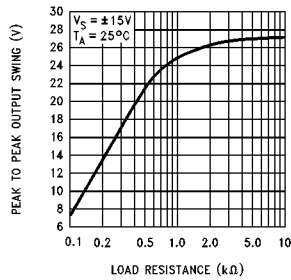
Common Mode Rejection Ratio vs Frequency



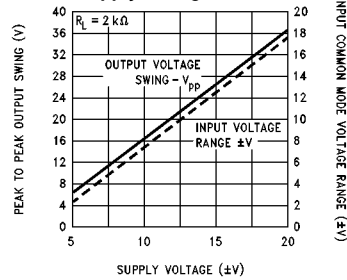
Output Voltage Swing vs Frequency



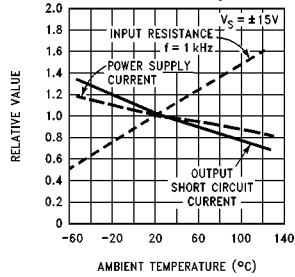
Output Voltage Swing vs Load Resistance



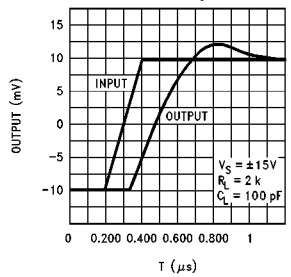
Output Swing and Input Range vs Supply Voltage



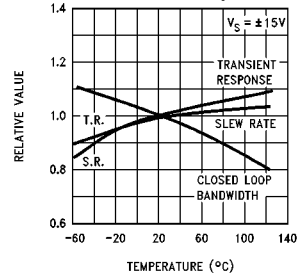
Normalized DC Parameters vs Ambient Temperature



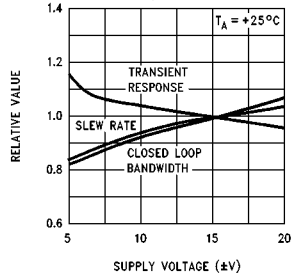
Transient Response



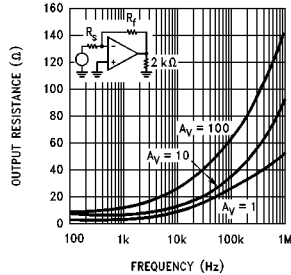
Frequency Characteristics vs Ambient Temperature



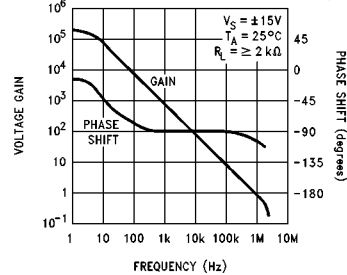
Frequency Characteristics vs Supply Voltage



Output Resistance vs Frequency



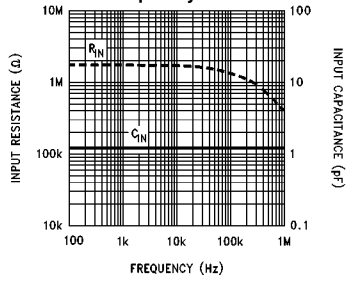
Open Loop Transfer Characteristics vs Frequency



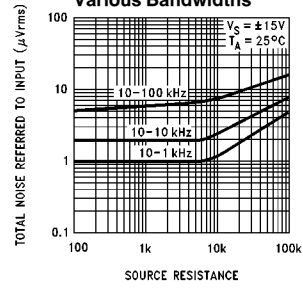
TL/H/11479-2

Typical Performance Characteristics (Continued)

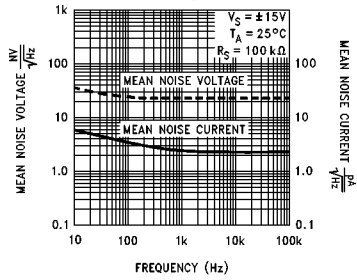
Input Resistance and Input Capacitance vs Frequency



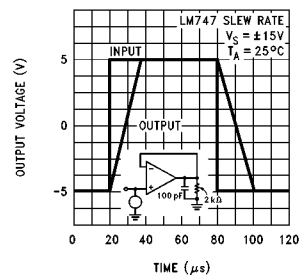
Broadband Noise for Various Bandwidths



Input Noise Voltage and Current vs Frequency

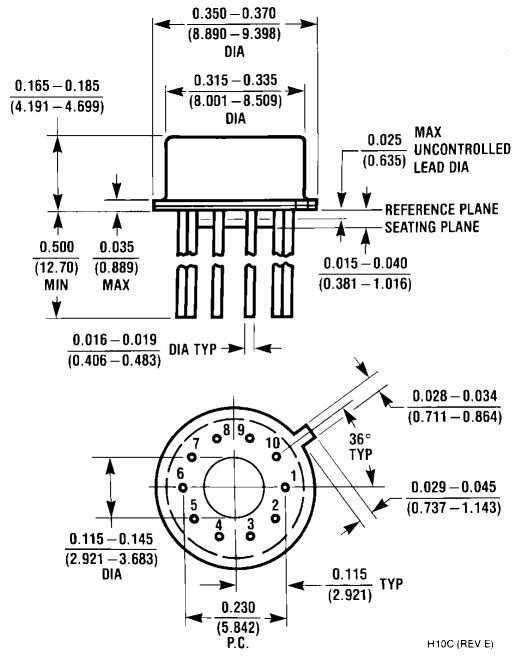


Voltage Follower Large Signal Pulse Response



TL/H/11479-3

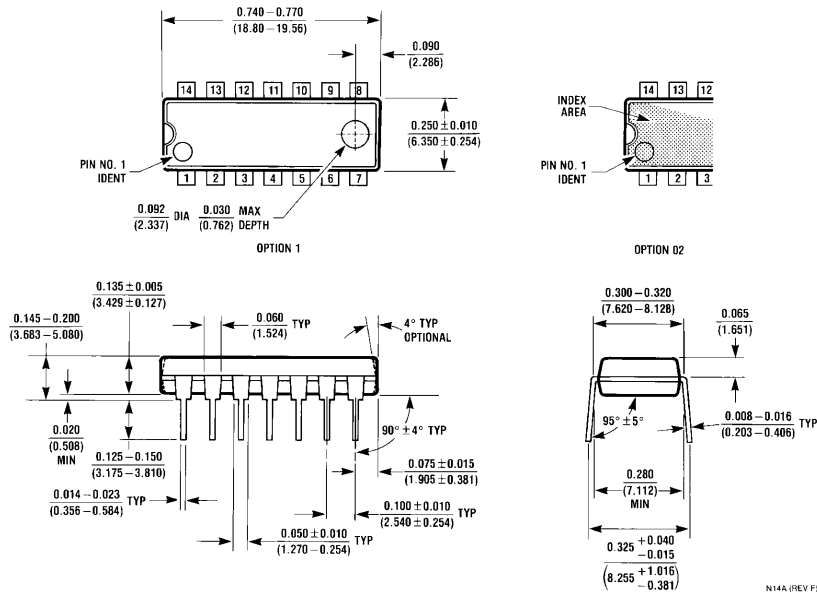
Physical Dimensions inches (millimeters)



H10C (REV E)

Metal Can Package (H)
Order Number LM747H
NS Package Number H10C

Physical Dimensions inches (millimeters) (Continued)



Dual-In-Line Package (N)
Order Number LM747CN or LM747EN
NS Package Number N14A

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



National Semiconductor Corporation
 1111 West Bardin Road
 Arlington, TX 76017
 Tel: 1(800) 272-9959
 Fax: 1(800) 737-7018

National Semiconductor Europe
 Fax: (+49) 0-180-530 85 86
 Email: cnjwge@tevm2.nsc.com
 Deutsch Tel: (+49) 0-180-530 85 85
 English Tel: (+49) 0-180-532 78 32
 Français Tel: (+49) 0-180-532 93 58
 Italiano Tel: (+49) 0-180-534 16 80

National Semiconductor Hong Kong Ltd.
 19th Floor, Straight Block,
 Ocean Centre, 5 Canton Rd.
 Tsimshatsui, Kowloon
 Hong Kong
 Tel: (852) 2737-1600
 Fax: (852) 2736-9960

National Semiconductor Japan Ltd.
 Tel: 81-043-299-2309
 Fax: 81-043-299-2408

National does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and National reserves the right at any time without notice to change said circuitry and specifications.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

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

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

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI 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 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. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

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

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

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 Mobile Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

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
Transportation and Automotive	www.ti.com/automotive
Video and Imaging	www.ti.com/video

TI E2E Community Home Page

e2e.ti.com

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2011, Texas Instruments Incorporated