Dual Output Driver

FEATURES

- Dual, 1.5A Totem Pole Outputs

- 40nsec Rise and Fall into 1000pF

- Parallel or Push-Pull Operation

- Single-Ended to Push-Pull Conversion

- High-Speed, Power MOSFET Compatible

- Low Cross-Conduction Current Spike

- Analog, Latched Shutdown

- Internal Deadband Inhibit Circuit

- Low Quiescent Current

- 5 to 40V Operation

- Thermal Shutdown Protection

- 16-Pin Dual-In-Line Package

- 20-Pin Surface Mount Package

DESCRIPTION

The UC1706 family of output drivers are made with a high-speed Schottky process to interface between low-level control functions and high-power switching devices - particularly power MOSFET's. These devices implement three generalized functions as outlined below.

First: They accept a single-ended, low-current digital input of either polarity and process it to activate a pair of high-current, totem pole outputs which can source or sink up to 1.5A each.

Second: They provide an optional single-ended to push-pull conversion through the use of an internal flip-flop driven by double-pulse-suppression logic. With the flip-flop disabled, the outputs work in parallel for 3.0A capability.

Third: Protection functions are also included for pulse-by-pulse current limiting, automatic deadband control, and thermal shutdown.

These devices are available in a two-watt plastic "bat-wing" DIP for operation over a 0°C to 70°C temperature range and, with reduced power, in a hermetically sealed cerdip for -55°C to +125°C operation. Also available in surface mount Q and L packages.
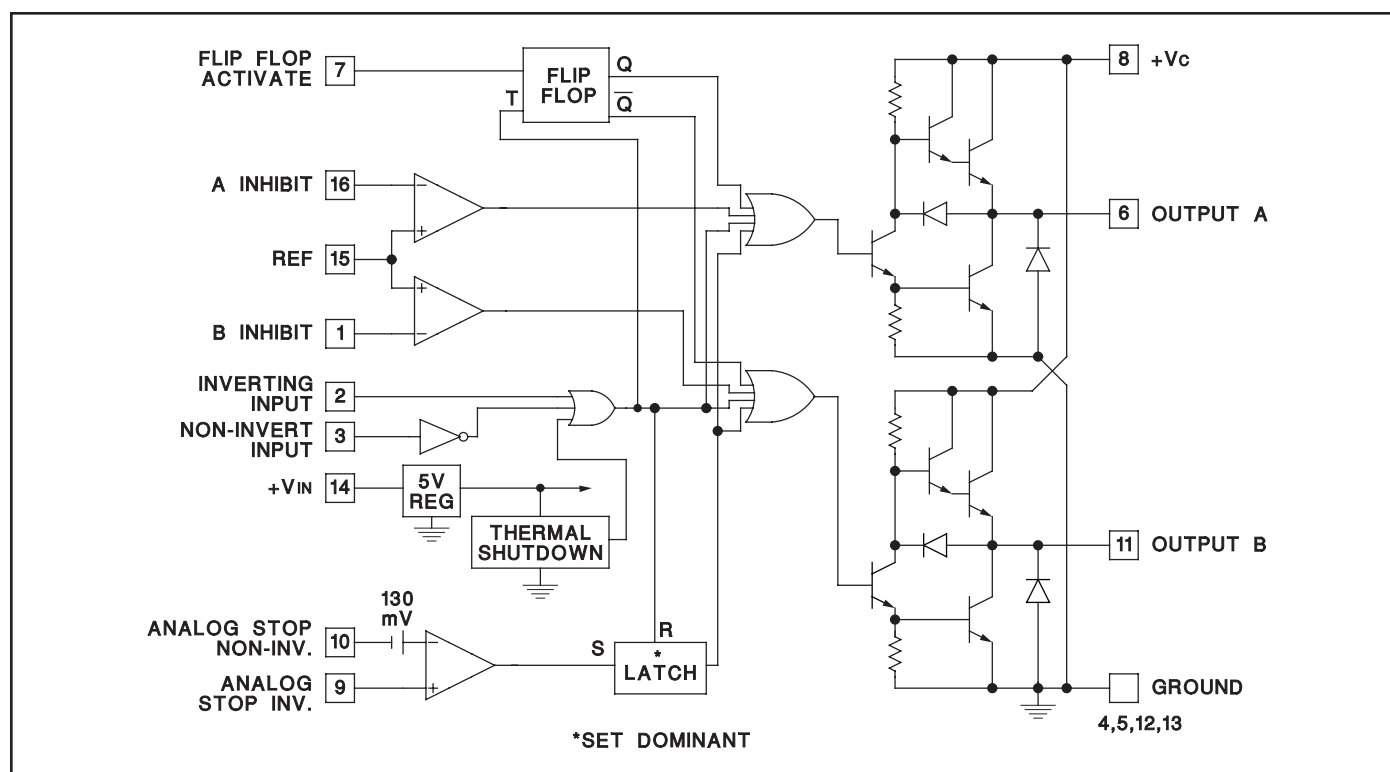
TRUTH TABLE

INV	N.I	OUT
H	H	L
L	H	H
H	L	L
L	L	L

$OUT = \overline{INV}$ and N.I.

$\overline{OUT} = INV$ or $\overline{N.I.}$

BLOCK DIAGRAM

ABSOLUTE MAXIMUM RATINGS

```
 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .  N--Pkg . . . . . . . . . . . . . .  J--Pkg
Supply Voltage, VIN . . . . . . . . . . . . . . . . . . . . . . . . 40V . . . . . . . . . . . . . . . . . 40V
Collector Supply Voltage, VC . . . . . . . . . . . . . . . . . . 40V . . . . . . . . . . . . . . . . . 40V
Output Current (Each Output, Source or Sink)
   Steady--State . . . . . . . . . . . . . . . . . . . . . . . . . . ±500mA. . . . . . . . . . . . . . ±500mA
   Peak Transient . . . . . . . . . . . . . . . . . . . . . . . . . . ±1.5A. . . . . . . . . . . . . . . . ±1.0A
   Capacitive Discharge Energy  . . . . . . . . . . . . . . . 20μJ . . . . . . . . . . . . . . . . . 15μJ
Digital Inputs . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 5.5V . . . . . . . . . . . . . . . . . 5.5V
Analog Stop Inputs . . . . . . . . . . . . . . . . . . . . . . . . . . VIN. . . . . . . . . . . . . . . . . VIN
Power Dissipation at TA = 25°C (See Note) . . . . . . 2W  . . . . . . . . . . . . . . . . . 1W
Power Dissipation at T (Leads/Case) = 25°C . . . . . . 5W . . . . . . . . . . . . . . . . . . 2
   (See Note)
Operating Temperature Range . . . . . . . . . . . . . . . . . . . . . . --55°C to +125°C
Storage Temperature Range. . . . . . . . . . . . . . . . . . . . . . . --65°C to +150°C
Lead Temperature (Soldering, 10 Seconds) . . . . . . . . . . . . . . . . 300°C
```
Note: All voltages are with respect to the four ground pins which must be connected together. All currents are positive into, negative out of the specified trerminal. Consult Packaging sections of the Databook for thermal limitations and considerations of package.

CONNECTION DIAGRAMS
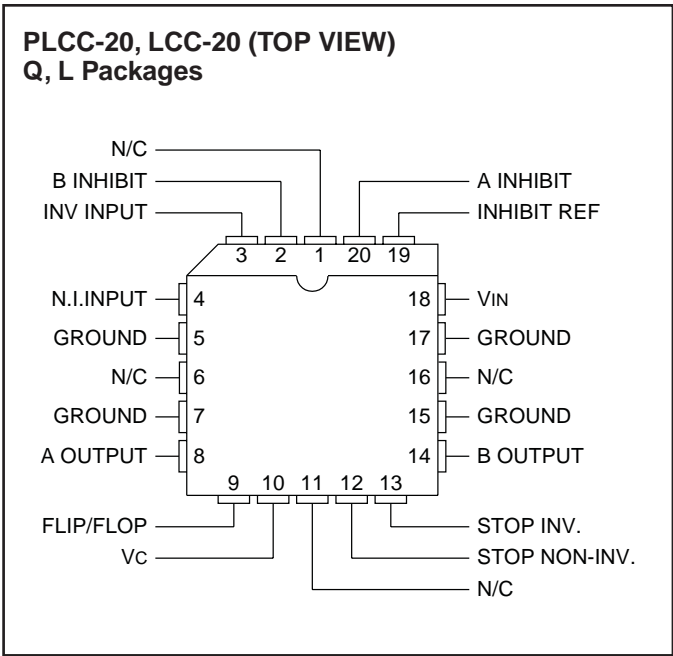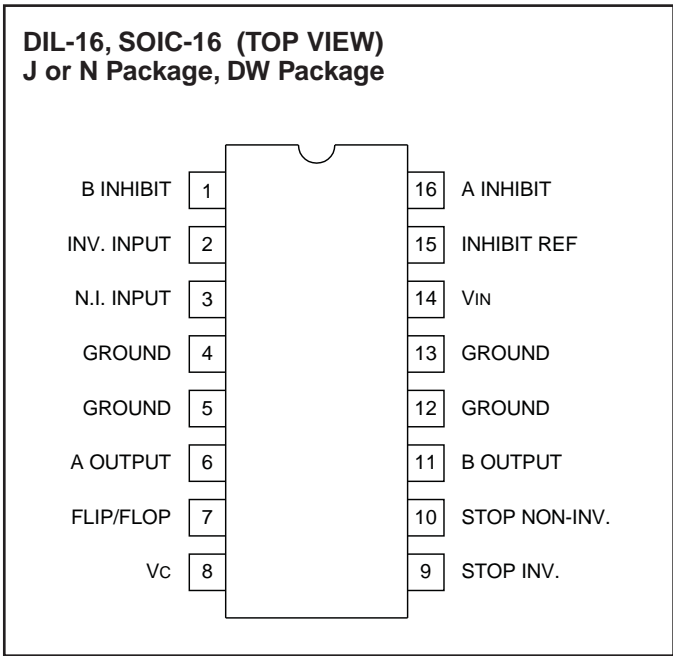
Note: All four ground pins must be connected to a common ground.

ELECTRICAL CHARACTERISTICS: Unless otherwise stated, these specifications apply for TA = −55°C to +125°C for the UC1706, −25°C to +85°C for the UC2706 and 0°C to +70°C for the UC3706; VIN = VC = 20V. TA = TJ.

PARAMETERS	TEST CONDITIONS	MIN	TYP	MAX	UNITS
VIN Supply Current	VIN = 40V		8	10	mA
VC Supply Current	VC = 40V, Outputs Low		4	5	mA
VC Leakage Current	VIN = 0, VC = 30V, No Load		.05	0.1	mA
Digital Input Low Level				0.8	V
Digital Input High Level		2.2			V
Input Current	VI = 0		−0.6	−1.0	mA
Input Leakage	VI = 5V		.05	0.1	mA

ELECTRICAL CHARACTERISTICS: Unless otherwise stated, these specifications apply for T_A = –55°C to +125°C for the UC1706, –25°C to +85°C for the UC2706 and 0°C to +70°C for the UC3706; V_{IN} = V_C = 20V. T_A = T_J.

PARAMETERS	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Output High Sat., V_C-V_O	I_O = -50mA			2.0	V
Output Low Sat., V_O	I_O = 50mA			0.4	V
	I_O = 500mA			2.5	V
Inhibit Threshold	V_{REF} = 0.5V	0.4		0.6	V
	V_{REF} = 3.5V	3.3		3.7	V
Inhibit Input Current	V_{REF} = 0		–10	–20	µA
Analog Threshold	V_{CM} = 0 to 15V, for the UC2706 and UC3706	100	130	160	mV
	V_{CM} = 0 to 15V, for the UC1706	80	130	160	mV
Input Bias Current	V_{CM} = 0		–10	–20	µA
Thermal Shutdown			155		°C

TYPICAL SWITCHING CHARACTERISTICS: V_{IN} = V_C = 20V, T_A = 25°C. Delays measured to 10% output change.

PARAMETERS	TEST CONDITIONS	OUTPUT C_L =			UNITS
From Inv. Input to Output:		open	1.0	2.2	nF
Rise Time Delay		110	130	140	ns
10% to 90% Rise		20	40	60	ns
Fall Time Delay		80	90	110	ns
90% to 10% Fall		25	30	50	ns
From N. I. Input to Output:					
Rise Time Delay		120	130	140	ns
10% to 90% Rise		20	40	60	ns
Fall Time Delay		100	120	130	ns
90% to 10% Fall		25	30	50	ns
V_C Cross-Conduction Current Spike Duration	Output Rise	25			ns
	Output Fall	0			ns
Inhibit Delay	Inhibit Ref. = 1V, Inhibit Inv. = 0.5 to 1.5V	250			ns
Analog Shutdown Delay	Stop Non-Inv. = 0V, Stop Inv. = 0 to 0.5V	180			ns

CIRCUIT DESCRIPTION

Outputs
The totem-pole outputs have been designed to minimize cross-conduction current spikes while maximizing fast, high-current rise and fall times. Current limiting can be done externally either at the outputs or at the common V_C pin. The output diodes included have slow recovery and should be shunted with high-speed external diodes when driving high-frequency inductive loads.

Flip/Flop
Grounding pin 7 activates the internal flip-flop to alternate the two outputs. With pin 7 open, the two outputs operate simultaneously and can be paralleled for higher current operation. Since the flip-flop is triggered by the digital input, an off-time of at last 200nsec must be provided to allow the flip/flop to change states. Note that the circuit logic is configured such that the "OFF" state is defined as the outputs low.
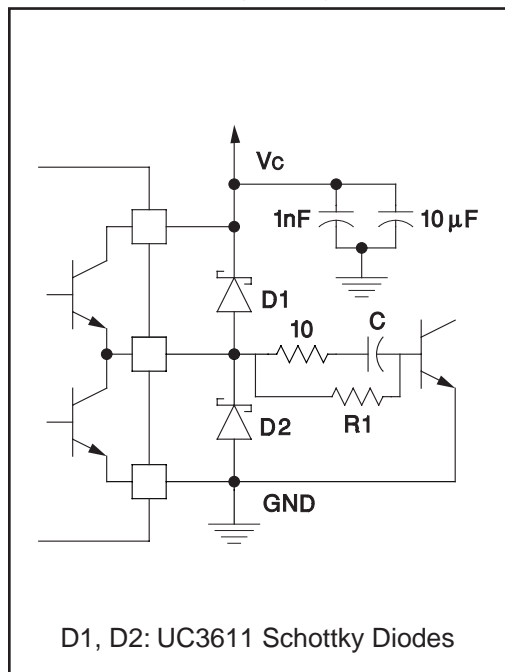
Digital Inputs
With both an inverting and non-inverting input available, either active-high or active-low signals may be accepted. These are true TTL compatible inputs—the threshold is approximately 1.2V with no hysteresis; and external pull-up resistors are not required.
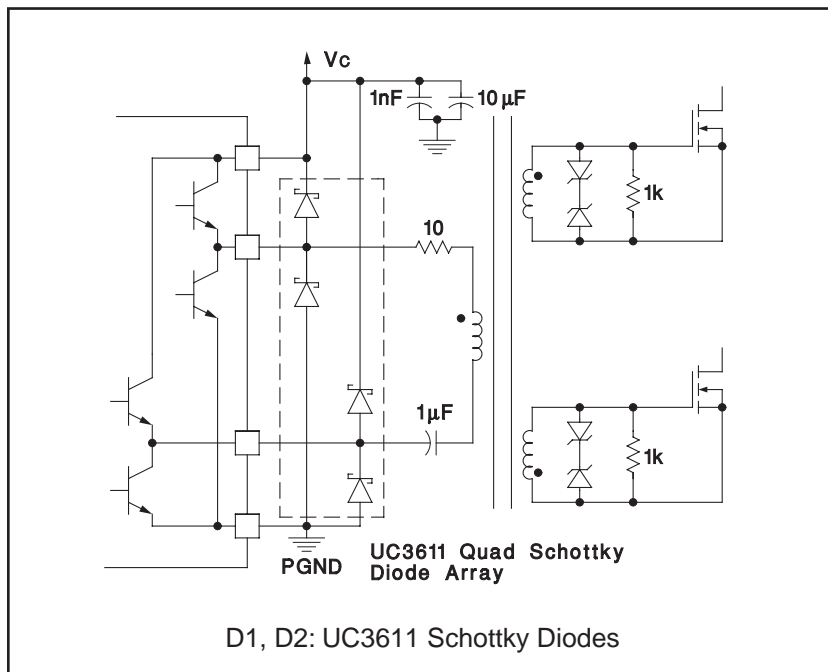
Inhibit Circuit
Although it may have other uses, this circuit is included to eliminate the need for deadband control when driving relatively slow bipolar power transistors. A diode from each inhibit input to the opposite power switch collector will keep one output from turning-on until the other has turned-off. The threshold is determined by the voltage on pin 15 which can be set from 0.5 to 3.5V. When this circuit is not used, ground pin 15 and leave 1 and 16 open.
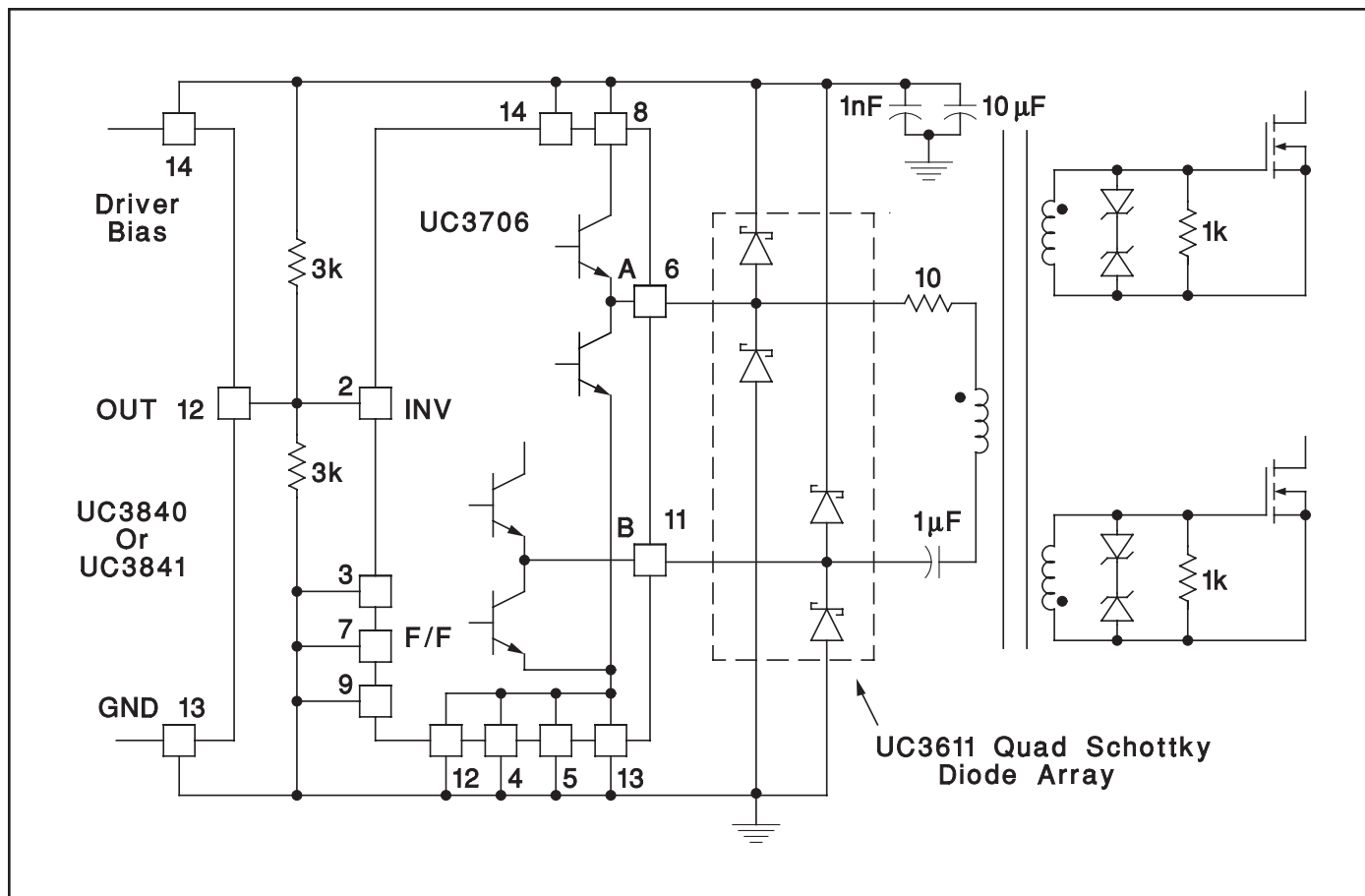
3

CIRCUIT DESCRIPTION (cont.)

Analog Shutdown

This circuit is included to get a latched shutdown as close to the outputs as possible, from a time standpoint. With an internal 130mV threshold, this comparator has a common-mode range from ground to (VIN – 3V). When not used, both inputs should be grounded. The time required for this circuit to latch is inversely proportional to the amount of overdrive but reaches a minimum of 180nsec. As with the flip-flop, an input off-time of at least 200nsec is required to reset the latch between pulses.

Supply Voltage

With an internal 5V regulator, this circuit is optimized for use with a 7 to 40V supply; however, with some slight response time degradation, it can also be driven from 5V. When VIN is low, the entire circuit is disabled and no current is drawn from VC. When combined with a UC1840 PWM, the Driver Bias switch can be used to supply VIN to the UC1706. VIN switching should be fast as if VC is high, undefined operation of the outputs may occur with VIN less than 5V.

Thermal Considerations

Should the chip temperature reach approximately 155°C, a parallel, non--inverting input is activated driving both outputs to the low state.

APPLICATIONS

D1, D2; UC3611 Schottky Diodes

Power MOSFET Drive Circuit

D1, D2; UC3611 Schottky Diodes

Power MOSFET Drive Circuit Using Negative Bias Voltage and Level Shifting to Ground Referenced PWMs

D1, D2: UC3611 Schottky Diodes

Transformer Coupled MOSFET Drive Circuit

Charge Pump Circuits

APPLICATIONS (cont'd)

D1, D2: UC3611 Schottky Diodes

Power Bipolar Drive Circuit

D1, D2: UC3611 Schottky Diodes

Transformer Coupled Push-Pull MOSFET Drive Circuit

UC3706 Converts Single Output PWMs to High Current Push-Pull Configuration

5

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
5962-89611012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962-89611012A	Samples
5962-8961101EA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8961101EA	Samples
UC1706J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	UC1706J	Samples
UC1706J883B	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	UC1706J/883B	Samples
UC1706L	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	UC1706L	Samples
UC2706DW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	UC2706DW	Samples
UC2706DWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	UC2706DW	Samples
UC2706J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-40 to 85	UC2706J	Samples
UC2706N	ACTIVE	PDIP	N	16	25	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type	-40 to 85	UC2706N	Samples
UC2706NG4	ACTIVE	PDIP	N	16	25	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type	-40 to 85	UC2706N	Samples
UC3706DW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	0 to 70	UC3706DW	Samples
UC3706DWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	0 to 70	UC3706DW	Samples
UC3706DWTR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	0 to 70	UC3706DW	Samples
UC3706DWTRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	0 to 70	UC3706DW	Samples
UC3706J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	0 to 70	UC3706J	Samples
UC3706N	ACTIVE	PDIP	N	16	25	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type	0 to 70	UC3706N	Samples
UC3706NG4	ACTIVE	PDIP	N	16	25	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type	0 to 70	UC3706N	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] Only one of markings shown within the brackets will appear on the physical 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.

OTHER QUALIFIED VERSIONS OF UC1706, UC2706, UC2706M, UC3706, UC3706M :

● Catalog: UC3706, UC2706, UC3706M, UC3706

● Military: UC2706M, UC1706, UC1706

NOTE: Qualified Version Definitions:

   ● Catalog - TI's standard catalog product

   ● Military - QML certified for Military and Defense Applications

IMPORTANT NOTICE

Products		**Applications**	
Audio	www.ti.com/audio	Automotive and Transportation	www.ti.com/automotive
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Applications Processors	www.ti.com/omap	**TI E2E Community**	e2e.ti.com
Wireless Connectivity	www.ti.com/wirelessconnectivity		