FRONTGRADE

DATASHEET

UT54ACS14E/UT54ACTS14E

Hex Inverting Schmitt Triggers

1/15/2018

Version #: 1.0

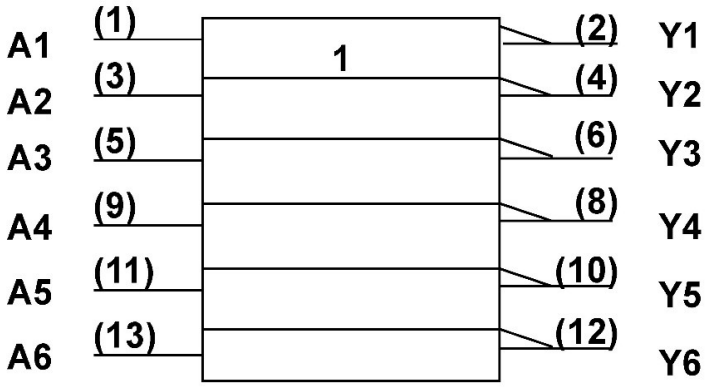
Features

- 0.6µm CRH CMOS Process
  - > Latchup immune
- High speed
- Low power consumption
- Wide power supply operating range of 3.0V to 5.5V
- Available QML Q or V processes
- 14-lead flatpack
- UT54ACS14E - SMD 5962-96524
- UT54ACTS14E - SMD 5962-96525

Function Table

Input A	Output Y
H	L
L	H

Logic Symbol



Note:

1. Logic symbol in accordance with ANSI/IEEE standard 91-1984 and IEC Publication 617-12.

Description

The UT54ACS14E and the UT54ACTS14E are hex inverters with Schmitt trigger inputs. The circuits perform the Boolean function Y = $\overline{A}$.

The devices are characterized over full HiRel temperature range of -55°C to +125°C.

Pinouts

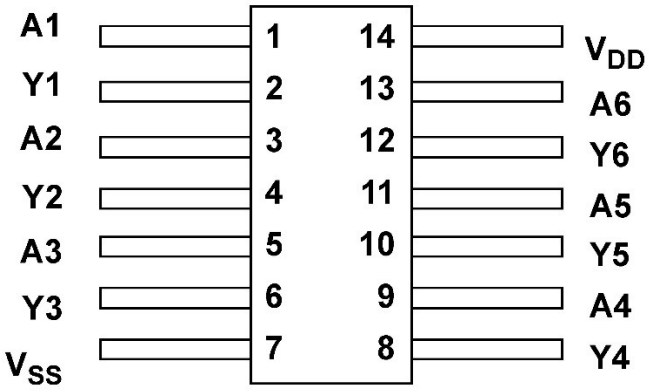
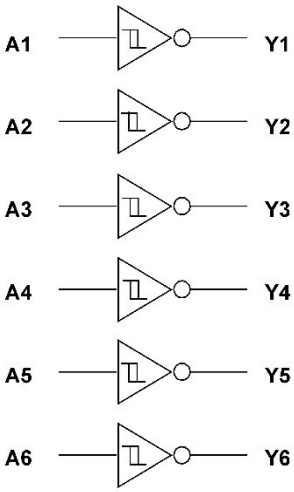


Figure 1: 14-Lead Flatpack
Top View

Logic Diagram



Operational Environment[1]

Parameter	Limit	Units
Total Dose	1.0E6	rads(Si)
SEU Threshold[2]	80	MeV-cm^2/mg
SEL Threshold	108	MeV-cm^2/mg
Neutron Fluence	1.0E14	n/cm^2

Notes:

1. Logic will not latchup during radiation exposure within the limits defined in the table.
2. Device storage elements are immune to SEU affects.

Absolute Maximum Ratings

Symbol	Parameter	Limit	Units
V_{DD}	Supply voltage	-0.3 to 7.0	V
$V_{I/O}$	Voltage any pin	-0.3 to V_{DD} +0.3	V
T_{STG}	Storage Temperature range	-65 to +150	°C
T_J	Maximum junction temperature	+175	°C
T_{LS}	Lead temperature (soldering 5 seconds)	+300	°C
Θ_{JC}	Thermal resistance junction to case	(ACS) 15.5 (ACTS)	°C/W
I_I	DC input current	±10	mA
P_D	Maximum package power dissipation permitted @ T_C= +125°C	3.3	W

Note:

1. Stresses outside the listed absolute maximum ratings may cause permanent damage to the device. This is a stress rating only, functional operation of the device at these or any other conditions beyond limits indicated in the operational sections is not recommended. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
2. Per MIL-STD-883, method 1012.1, Section 3.4.1, $P_D = (T_{J(max)} - T_{C(max)}) / \Theta_{JC}$

Recommended Operating Conditions

Symbol	Parameter	Limit	Units
V_{DD}	Supply voltage	3.0 to 5.5	V
V_{IN}	Input voltage any pin	0 to V_{DD}	V
T_C	Temperature range	-55 to +125	°C

DC Electrical Characteristics for the UT54ACS14E[7]

(V_{DD} = 3.0V to 5.5V; V_{SS} = 0V[6]; -55°C < T_C < +125°C)

Symbol	Description		Condition	MIN	MAX	Units
V_{T+}	Schmitt trigger positive-going threshold[1]		V_{DD} from 3.0V to 5.5V		0.7V_{DD}	V
V_{T-}	Schmitt trigger negative-going threshold[1]		V_{DD} from 3.0V to 5.5V	0.3V_{DD}		V
V_{H1}	Range of hysteresis (V_{T+} - V_{T-})		V_{DD} from 4.5V to 5.5V	0.6	1.5	V
V_{H2}	Range of hysteresis (V_{T+} - V_{T-})		V_{DD} from 3.0V to 3.6V	0.3	1.2	V
I_{IN}	Input leakage current		V_{IN} = V_{DD} or V_{SS}	-1	1	µA
V_{OL}	Low-level output voltage[3]		I_{OL} = 100µA V_{DD} from 3.0V to 5.5V		0.25	V
V_{OH}	High-level output voltage[3]		I_{OH} = -100µA V_{DD} from 3.0V to 5.5V	V_{DD} - 0.25		V
I_{OS1}	Short-circuit output current[2,4]		V_O = V_{DD} and V_{SS} V_{DD} from 4.5V to 5.5V	-200	200	mA
I_{OS2}	Short-circuit output current[2,4]		V_O = V_{DD} and V_{SS} V_{DD} from 3.0V to 3.6V	-100	100	mA
I_{OL1}	Low level output current[9] (sink)		V_{IN} = V_{DD} or V_{SS} V_{OL} = 0.4V V_{DD} from 4.5V to 5.5V	8		mA
I_{OL2}	Low level output current[9] (sink)		V_{IN} = V_{DD} or V_{SS} V_{OL} = 0.4V V_{DD} from 3.0V to 3.6V	6		mA
I_{OH1}	High level output current[9] (source)		V_{IN} = V_{DD} or V_{SS} V_{OH} = V_{DD} - 0.4V V_{DD} from 4.5V to 5.5V	-8		mA
I_{OH2}	High level output current[9] (source)		V_{IN} = V_{DD} or V_{SS} V_{OH} = V_{DD} - 0.4V V_{DD} from 3.0V to 3.6V	-6		mA
P_{total1}	Power dissipation[2,8]		C_L = 50pF V_{DD} from 4.5V to 5.5V		1.8	mW/ MHz
P_{total2}	Power dissipation[2,8]		C_L = 50pF V_{DD} from 3.0V to 3.6V		0.72	mW/ MHz
I_{DDQ}	Quiescent Supply Current	Pre-Rad All Device Types	V_{IN} = V_{DD} or V_{SS} V_{DD} = V_{DD} MAX		10	µA
		Post-Rad Device Type - 03			50	
		Post-Rad Device Type - 02			130	
C_{IN}	Input capacitance[5]		f = 1MHz, V_{DD} = 0		15	pF
C_{OUT}	Output capacitance[5]		f = 1MHz, V_{DD} = 0		15	pF

Notes:

1. Functional tests are conducted in accordance with MIL-STD-883 with the following input test conditions: $V_{IH} = V_{IH}(min) + 20\%, - 0\%$; $V_{IL} = V_{IL}(max) + 0\%, - 50\%$, as specified herein, for TTL, CMOS, or Schmitt compatible inputs. Devices may be tested using any input voltage within the above specified range, but are guaranteed to $V_{IH}(min)$ and $V_{IL}(max)$.
2. Supplied as a design limit but not guaranteed or tested.
3. Per MIL-PRF-38535, for current density ≤5.0E5 amps/cm^2, the maximum product of load capacitance (per output buffer) times frequency should not exceed 3,765pF/MHz.
4. Not more than one output may be shorted at a time for maximum duration of one second.
5. Capacitance measured for initial qualification and when design changes may affect the value. Capacitance is measured between the designated terminal and V_{SS} at frequency of 1MHz and a signal amplitude of 50mV rms maximum.
6. Maximum allowable relative shift equals 50mV.
7. Device type 02 is only offered with a TID tolerance guarantee of 3E5 rads(Si), and 1E6 rads(Si), and is tested in accordance with MIL-STD-883 Test Method 1019 Condition A and section 3.11.2. Device type 03 is only offered with a TID tolerance guarantee of 1E5 rads(Si), 3E5 rads(Si), and 5E5 rads(Si), and is tested in accordance with MIL-STD-883 Test Method 1019 Condition A.
8. Power dissipation specified per switching output.
9. Guaranteed by characterization, but not tested.

AC Electrical Characteristics for the UT54ACS14E[2]

(V_{DD} = 3.0V to 5.5V; V_{SS} = 0V[1], -55°C < T_C < +125°C)

Symbol	Parameter	Condition	VDD	Minimum	Maximum	Unit
t_{PHL}	Input to Yn	C_L = 50pF	3.0V to 3.6V	2	18	ns
			4.5V to 5.5V	2	14	ns
t_{PLH}	Input to Yn	C_L = 50pF	3.0V to 3.6V	2	17	ns
			4.5V to 5.5V	2	13	ns
t_{PHL}	Input to Yn	C_L = 30pF	3.0V to 3.6V	2	14	ns
			4.5V to 5.5V	2	10	ns
t_{PLH}	Input to Yn	CL = 30pF	3.0V to 3.6V	2	13	ns
			4.5V to 5.5V	2	9	ns

Notes:

1. Maximum allowable relative shift equals 50mV.
2. Device type 02 is only offered with a TID tolerance guarantee of 3E5 rads(Si), and 1E6 rads(Si), and is tested in accordance with MIL-STD-883 Test Method 1019 Condition A and section 3.11.2. Device type 03 is only offered with a TID tolerance guarantee of 1E5 rads(Si), 3E5 rads(Si), and 5E5 rads(Si), and is tested in accordance with MIL-STD-883 Test Method 1019 Condition A.

DC Electrical Characteristics for the UT54ACTS14E[7]

(V_{DD} = 3.0V to 5.5V; V_{SS} = 0V[6]; -55°C < T_C < +125°C)

Symbol	Description		Condition	MIN	MAX	Unit
V_{T+1}	Schmitt trigger positive-going threshold[1]		V_{DD} from 4.5V to 5.5V		2.25	V
V_{T+2}	Schmitt trigger positive-going threshold[1]		V_{DD} from 3.0V to 3.6V		2.0	V
V_{T-1}	Schmitt trigger negative-going threshold [1]		V_{DD} from 4.5V to 5.5V	0.5		V
V_{T-2}	Schmitt trigger negative-going threshold[1]		V_{DD} from 3.0V to 3.6V	0.5		V
V_{H1}	Range of hysteresis (V_{T+1} - V_{T-1})		V_{DD} from 4.5V to 5.0V	0.4	1.5	V
V_{H2}	Range of hysteresis (V_{T+2} - V_{T-2})		V_{DD} from 3.0V to 3.6V	0.2	1.2	V
I_{IN}	Input leakage current		V_{IN} = V_{DD} or V_{SS}	-1	1	µA
V_{OL1}	Low-level output voltage[3]		I_{OL} = 8mA V_{DD} from 4.5V to 5.5V		0.4	V
V_{OL2}	Low-level output voltage[3]		I_{OL} = 6mA V_{DD} from 3.0V to 3.6V		0.4	V
V_{OH1}	High-level output voltage[3]		I_{OH} = -8mA V_{DD} from 4.5V to 5.5V	0.7V_{DD}		V
V_{OH2}	High-level output voltage[3]		I_{OH} = -6mA V_{DD} from 3.0V to 3.6V	2.4		V
I_{OS1}	Short-circuit output current[2,4]		V_O = V_{DD} or V_{SS} V_{DD} from 4.5V to 5.5V	-200	200	mA
I_{OS1}	Short-circuit output current[2,4]		V_O = V_{DD} or V_{SS} V_{DD} from 3.0V to 3.6V	-100	100	mA
I_{OL1}	Low level output current[9]		V_{IN} = V_{DD} or V_{SS} V_{OL} = 0.4V V_{DD} from 4.5V to 5.5V	8		mA
I_{OL2}	Low level output current[9]		V_{IN} = V_{DD} or V_{SS} V_{OL} = 0.4V V_{DD} from 3.0V to 3.6V	6		mA
IOH1	High level output current[9]		V_{IN} = V_{DD} or V_{SS} V_{OH} = V_{DD}-0.4V, V_{DD} from 4.5V to 5.5V	-8		mA
IOH2	High level output current[9]		V_{IN} = V_{DD} or V_{SS} V_{OH} = V_{DD} - 0.4V V_{DD} from 3.0V to 3.6V	-6		mA
Ptotal1	Power dissipation[2,8]		C_L = 50pF V_{DD} from 4.5V to 5.5V		1.3	mW/ MHz
P_{total2}	Power dissipation[2,8]		C_L = 50pF V_{DD} from 3.0V to 3.6V		0.5	mW/ MHz
I_{DDQ}	Quiescent Supply Current	Pre-Rad All Device Types	V_{IN} = V_{DD} or V_{SS} V_{DD} = V_{DD} MAX		10	µA
		Post-Rad Device Type - 03			50	
		Post-Rad Device Type - 02			130	

Symbol	Description	Condition	MIN	MAX	Unit
ΔI_{DDQ}	Quiescent Supply Current Delta	For input under test $V_{IN} = V_{DD}$ -2.1V For all other inputs $V_{IN} = V_{DD}$ or V_{SS} V_{DD} = 5.5V		3.1	mA
C_{IN}	Input capacitance[5]	f = 1MHz, V_{DD} = 0		15	pF
C_{OUT}	Output capacitance[5]	f = 1MHz, V_{DD} = 0		15	pF

Notes:

1. Functional tests are conducted in accordance with MIL-STD-883 with the following input test conditions: $V_{IH} = V_{IH}(min) + 20\%, - 0\%$; $V_{IL} = V_{IL}(max) + 0\%, - 50\%$, as specified herein, for TTL, CMOS, or Schmitt compatible inputs. Devices may be tested using any input voltage within the above specified range, but are guaranteed to $V_{IH}(min)$ and $V_{IL}(max)$.
2. Supplied as a design limit but not guaranteed or tested.
3. Per MIL-PRF-38535, for current density ≤5.0E5 amps/cm^2, the maximum product of load capacitance (per output buffer) times frequency should not exceed 3,765pF/MHz.
4. Not more than one output may be shorted at a time for maximum duration of one second.
5. Capacitance measured for initial qualification and when design changes may affect the value. Capacitance is measured between the designated terminal and V_{SS} at frequency of 1MHz and a signal amplitude of 50mV rms maximum.
6. Maximum allowable relative shift equals 50mV.
7. Device type 02 is only offered with a TID tolerance guarantee of 3E5 rads(Si), and 1E6 rads(Si), and is tested in accordance with MIL-STD-883 Test Method 1019 Condition A and section 3.11.2. Device type 03 is only offered with a TID tolerance guarantee of 1E5 rads(Si), 3E5 rads(Si), and 5E5 rads(Si), and is tested in accordance with MIL-STD-883 Test Method 1019 Condition A.
8. Power dissipation specified per switching output.
9. Guaranteed by characterization, but not tested.

AC Electrical Characteristics for the UT54ACTS14E[2]

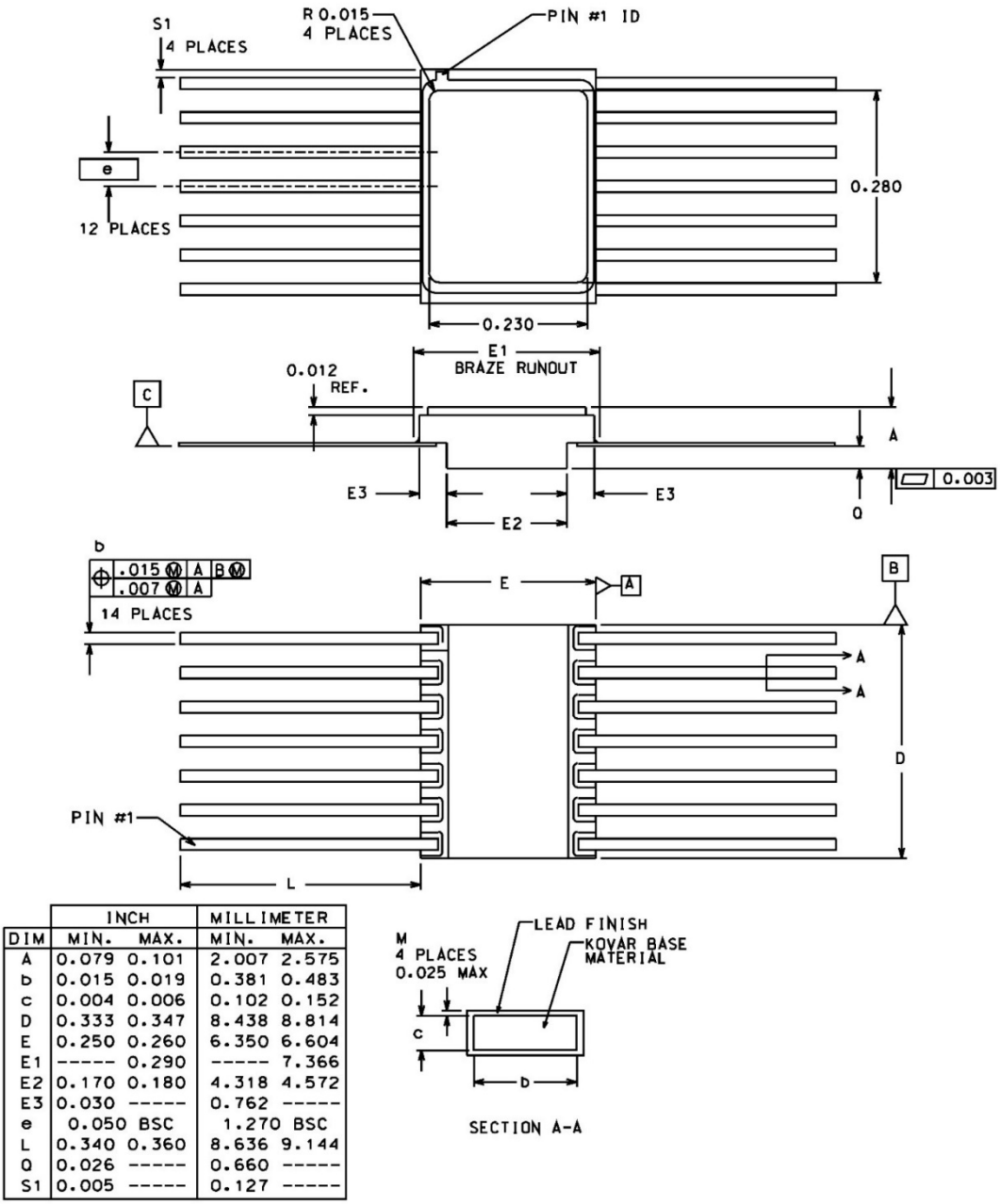
(V_{DD} = 3.0V to 5.5V; V_{SS} = 0V[1], -55°C < T_C < +125°C)

Symbol	Parameter	Condition	VDD	Minimum	Maximum	Unit
tPHL	Input to Yn	C_L = 50pF	3.0V to 3.6V	2	20	ns
			4.5V to 5.5V	2	9	
tPLH	Input to Yn	C_L = 50pF	3.0V to 3.6V	3	20	ns
			4.5V to 5.5V	2	12	

Notes:

1. Maximum allowable relative shift equals 50mV.
2. Device type 02 is only offered with a TID tolerance guarantee of 3E5 rads(Si), and 1E6 rads(Si), and is tested in accordance with MIL-STD-883 Test Method 1019 Condition A and section 3.11.2. Device type 03 is only offered with a TID tolerance guarantee of 1E5 rads(Si), 3E5 rads(Si), and 5E5 rads(Si), and is tested in accordance with MIL-STD-883 Test Method 1019 Condition A.

Packaging



DIM	INCH MIN.	INCH MAX.	MILLIMETER MIN.	MILLIMETER MAX.
A	0.079	0.101	2.007	2.575
b	0.015	0.019	0.381	0.483
c	0.004	0.006	0.102	0.152
D	0.333	0.347	8.438	8.814
E	0.250	0.260	6.350	6.604
E1	-----	0.290	-----	7.366
E2	0.170	0.180	4.318	4.572
E3	0.030	-----	0.762	-----
e	0.050 BSC		1.270 BSC	
L	0.340	0.360	8.636	9.144
Q	0.026	-----	0.660	-----
S1	0.005	-----	0.127	-----

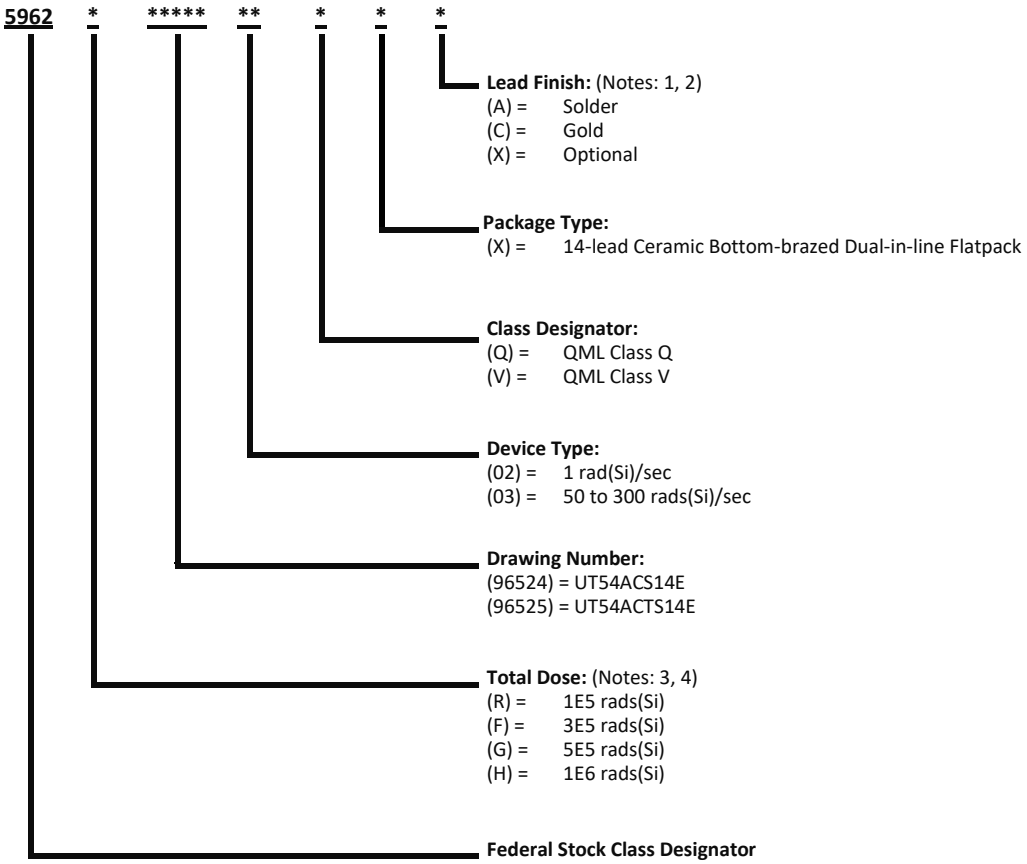
Figure 2: Figure 1: 14-lead Flatpack

Notes

1. All exposed metallized areas are gold plated over electroplated nickel per MIL-PRF-38535.
2. The lid is electrically connected to V_{SS}.
3. Lead finishes are in accordance with MIL-PRF-38535.
4. Dimension symbol is in accordance with MIL-PRF-38533.
5. Lead position and colanarity are not measured.

Ordering Information

UT54ACS14E/UT54ACTS14E SMD Part Number Ordering Information



Notes:

1. Lead finish (A, C or X) must be specified.
2. If an "X" is specified when ordering, part marking will match the lead finish and will be either "A" (solder) or "C" (gold).
3. Total dose radiation must be specified when ordering. QML-2 and V is not available without radiation testing. For prototyping inquiries, contact factory.
4. Device type 02 is only offered with a TID tolerance guarantee of 3E5 rads(Si) or 1E6 rads(Si) and is tested in accordance with MIL-STD-883 Test Method 1019 Condition A and section 3.11.2. Device type 03 is only offered with a TID tolerance guarantee of 1E5 rads(Si), 3E5 rads(Si), and 5E5 rads(Si), and is tested in accordance with MIL-STD-883 Test Method 1019 Condition A.

Revision History

Date	Revision #	Author	Change Description	Page #
10/17		RT	Edited PTOTAL2 Edited IDDQ AC Electricals Added new Frontgrade Data Sheet template to the document.	4, 5, 6
1/18		RT	Updates to reflect current SMD	

Datasheet Definitions

	Definition
Advanced Datasheet	Frontgrade reserves the right to make changes to any products and services described herein at any time without notice. The product is still in the development stage and the **datasheet is subject to change**. Specifications can be **TBD** and the part package and pinout are **not final.**
Preliminary Datasheet	Frontgrade reserves the right to make changes to any products and services described herein at any time without notice. The product is in the characterization stage and prototypes are available.
Datasheet	Product is in production and any changes to the product and services described herein will follow a formal customer notification process for form, fit or function changes.