UT54ACS164E/UT54ACTS164E

Radiation-Hardened
8-Bit Shift Registers

FEATURES

- AND-gated (enable/disable) serial inputs
- Fully buffered clock and serial inputs
- Direct clear
- 0.6µm CRH CMOS Process
  - Latchup immune
- High speed
- Low power consumption
- Wide operating power supply from 3.0V to 5.5V
- Available QML Q or V processes
- Flexible package
  - 14-lead flatpack

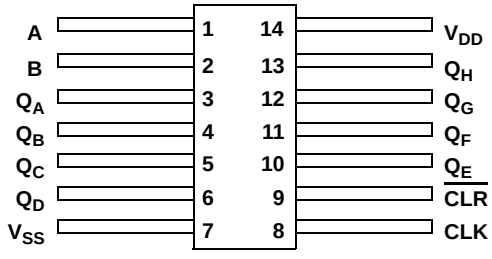
DESCRIPTION

The UT54ACS164E and the UT54ACTS164E are 8-bit shift registers which feature AND-gated serial inputs and an asynchronous clear. The gated serial inputs (A and B) permit complete control over incoming data. A low at either input inhibits entry of new data and resets the first flip-flop to the low level at the next clock pulse. A high-level at both serial inputs sets the first flip-flop to the high level at the next clock pulse. Data at the serial inputs may be changed while the clock is high or low, providing the minimum setup time requirements are met. Clocking occurs on the low-to-high-level transition of the clock input.

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

PINOUT

14-Lead Flatpack
Top View

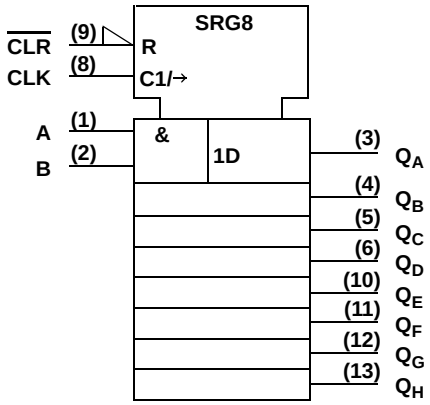


FUNCTION TABLE

INPUTS				OUTPUTS		
$\overline{CLR}$	CLK	A	B	Q_A	Q_B ... Q_H	
L	X	X	X	L	L	L
H	L	X	X	Q_{A0}	Q_{B0}	Q_{H0}
H	↑	H	H	H	Q_{An}	Q_{Gn}
H	↑	L	X	L	Q_{An}	Q_{Gn}
H	↑	X	L	L	Q_{An}	Q_{Gn}

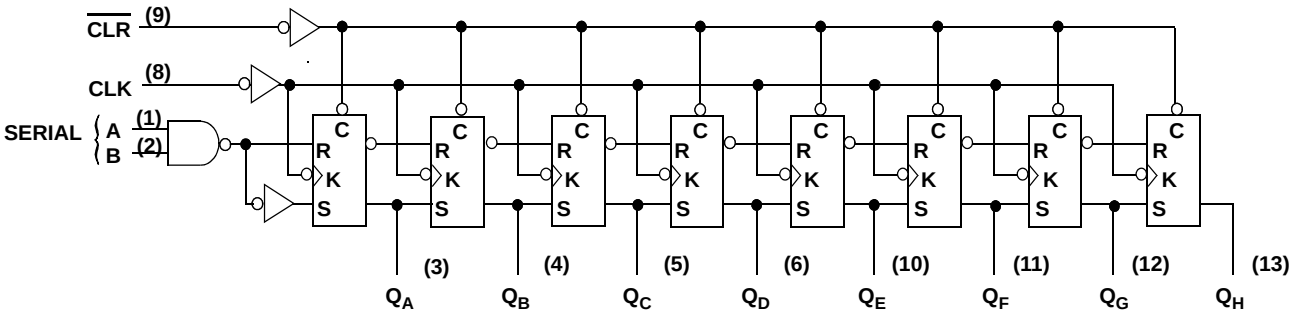
Notes:
1. Q_{A0}, Q_{B0}, Q_{H0} = the level of Q_A, Q_B or Q_H, respectively, before the indicated steady-state input conditions were established.
2. Q_{An} and Q_{Gn} = the level of Q_A or Q_G before the most recent ↑ transition of the clock; indicates a one-bit shift.

LOGIC SYMBOL



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

LOGIC DIAGRAM



RADIATION HARDNESS SPECIFICATIONS [1]

PARAMETER	LIMIT	UNITS
Total Dose	1.0E6	rads(Si)
SEU Threshold [2]	80	MeV-cm^2/mg
SEL Threshold	120	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	-.3 to V_{DD} + .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	20	°C/W
I_I	DC input current	±10	mA
P_D	Maximum power dissipation	1	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.

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 UT54ACS164E[7]

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

SYMBOL	Description	CONDITION	VDD	MIN	MAX	UNIT
V_{IL}	Low-level input voltage [1]		3.0V		0.9	V
			5.5V		1.65	
V_{IH}	High-level input voltage [1]		3.0V	2.1		V
			5.5V	3.85		
I_{IN}	Input leakage current	V_{IN} = V_{DD} or V_{SS}	5.5V	-1	1	µA
V_{OL}	Low-level output voltage [3]	I_{OL} = 100µA	3.0V		0.25	V
			4.5V		0.25	
V_{OH}	High-level output voltage [3]	I_{OH} = -100µA	3.0V	2.75		V
			4.5V	4.25		
I_{OS}	Short-circuit output current [2,4]	V_O = V_{DD} and V_{SS}	3.0V	-100	100	mA
			5.5V	-200	200	
I_{OL}	Low level output current[9]	V_{IN} = V_{DD} or V_{SS}	3.0V	6		mA
		V_{OL} = 0.4V	5.5V	8		
I_{OH}	High level output current[9]	V_{IN} = V_{DD} or V_{SS}	3.0V		-6	mA
		V_{OH} = V_{DD}-0.4V	5.5V		-8	
P_{total}	Power dissipation [2, 8]	C_L = 50pF	5.5V		1.9	mW/ MHz
I_{DDQ}	Quiescent Supply Current	V_{IN} = V_{DD} or V_{SS}	5.5V		10	µA
C_{IN}	Input capacitance [5]	*f* = 1MHz	0V		15	pF
C_{OUT}	Output capacitance [5]	*f* = 1MHz	0V		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. All specifications valid for radiation dose ≤ 1E6 rads(Si) per MIL-STD-883 Method 1019 Condition B.
8. Power dissipation specified per switching output.
10. This value is guaranteed based on characterization data, but not tested.

AC ELECTRICAL CHARACTERISTICS FOR THE UT54ACS164E[2]

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

SYMBOL	PARAMETER		V_{DD}	MINIMUM	MAXIMUM	UNIT
t_{PHL1}	CLK to Qn	C_L = 30pF	3.0V & 3.6V	4	21	ns
			4.5V & 5.5V	4	17	
		C_L = 50pF	3.0V & 3.6V	4	25	ns
			4.5V & 5.5V	4	21	
t_{PLH1}	CLK to Qn	C_L = 30pF	3.0V & 3.6V	2	18	ns
			4.5V & 5.5V	2	14	
		C_L = 50pF	3.0V & 3.6V	2	22	ns
			4.5V & 5.5V	2	18	
t_{PLH2}	$\overline{CLR}$ to Qn	C_L = 30pF	3.0V & 3.6V	5	21	ns
			4.5V & 5.5V	5	17	
		C_L = 50pF	3.0V & 3.6V	5	25	ns
			4.5V & 5.5V	5	21	
f_{MAX}	Maximum clock frequency	C_L = 50pF	3.0V, 4.5V, and 5.5V		83	MHz
t_{SU1}	Data setup time before CLK↑	C_L = 50pF	3.0V, 4.5V, and 5.5V	4		ns
t_{SU2}	$\overline{CLR}$ inactive Setup time before CLK ↑	C_L = 50pF	3.0V, 4.5V, and 5.5V	4		ns
t_H[3]	Data hold time after CLK ↑	C_L = 50pF	3.0V, 4.5V, and 5.5V	2		ns
t_W	Minimum pulse width $\overline{CLR}$ low CLK high CLK low	C_L = 50pF	3.0V, 4.5V, and 5.5V	6		ns

Notes:
1. Maximum allowable relative shift equals 50mV.
2. All specifications valid for radiation dose ≤ 1E6 rads(Si) per MIL-STD-883 Method 1019 Condition B.
3. Based on characterization, hold time (t_H) of 0ns can be assumed if data setup time (t_{SU1}) is ≥10ns. This is guaranteed, but not tested.

DC ELECTRICAL CHARACTERISTICS FOR THE UT54ACTS164E[7]

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

SYMBOL	Description	CONDITION	VDD	MIN	MAX	UNIT
V_{IL}	Low-level input voltage [1]		3.0V		0.8	V
			5.5V		0.8	
V_{IH}	High-level input voltage [1]		3.0V	2.0		V
			5.5V	2.75		
I_{IN}	Input leakage current	V_{IN} = V_{DD} or V_{SS}	5.5V	-1	1	µA
V_{OL}	Low-level output voltage [3]	I_{OL} = 6mA	3.0V		0.4	V
		I_{OL} = 8mA	4.5V		0.4	V
V_{OH}	High-level output voltage [3]	I_{OL} = -6mA	3.0V	2.4		V
		I_{OL} = -8mA	4.5V	3.15		V
I_{OS}	Short-circuit output current [2,4]	V_O = V_{DD} and V_{SS}	3.0V	-100	100	mA
			5.5V	-200	200	
I_{OL}	Low level output current[10]	V_{IN} = V_{DD} or V_{SS}	3.0V	6		mA
		V_{OL} = 0.4V	5.5V	8		
I_{OH}	High level output current[10]	V_{IN} = V_{DD} or V_{SS}	3.0V		-6	mA
		V_{OH} = V_{DD}-0.4V	5.5V		-8	
P_{total}	Power dissipation [2, 8, ,9]	C_L = 50pF	5.5V		1.9	mW/ MHz
I_{DDQ}	Quiescent Supply Current	V_{IN} = V_{DD} or V_{SS}	5.5V		10	µA
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}	5.5V		1.6	mA
C_{IN}	Input capacitance [5]	*f* = 1MHz	0V		15	pF
C_{OUT}	Output capacitance [5]	*f* = 1MHz	0V		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. All specifications valid for radiation dose ≤ 1E6 rads(Si) per MIL-STD-883 Method 1019 Condition B.
8. Power does not include power contribution of any TTL output sink current
9. Power dissipation specified per switching output.
10. This value is guaranteed based on characterization data, but not tested.

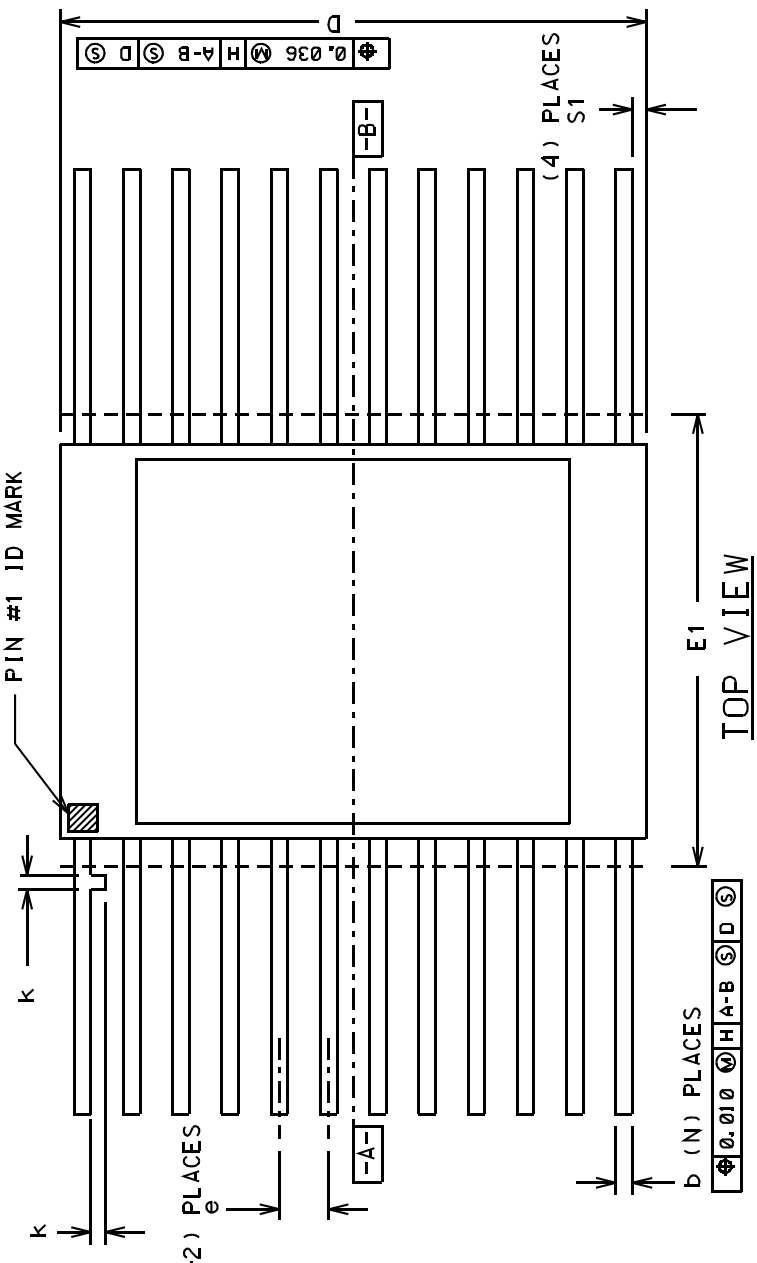
AC ELECTRICAL CHARACTERISTICS FOR THE UT54ACTS164E[2]

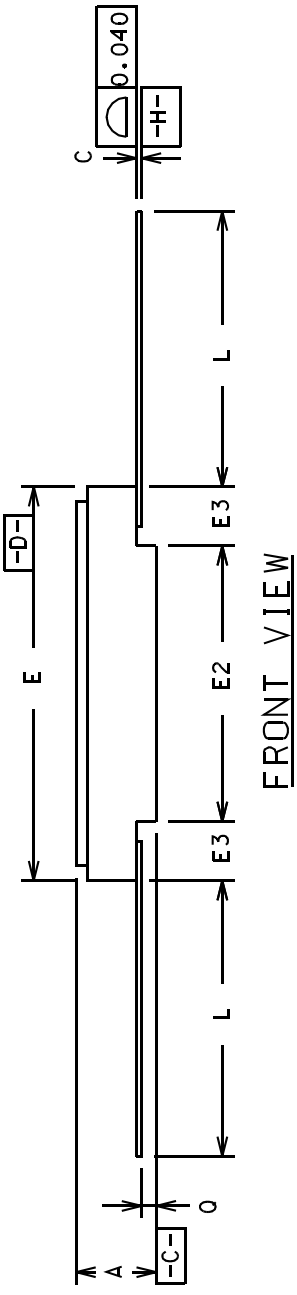
(V_{DD} = 3.0V to 5.5V; V_{SS} = 0V [1], -55°C < T_C < +125°C)

SYMBOL	PARAMETER		V_{DD}	MINIMUM	MAXIMUM	UNIT
t_{PHL1}	CLK to Qn	C_L = 30pF	3.0V & 3.6V	4	21	ns
			4.5V & 5.5V	4	17	
		C_L = 50pF	3.0V & 3.6V	4	25	ns
			4.5V & 5.5V	4	21	
t_{PLH1}	CLK to Qn	C_L = 30pF	3.0V & 3.6V	2	18	ns
			4.5V & 5.5V	2	14	
		C_L = 50pF	3.0V & 3.6V	2	22	ns
			4.5V & 5.5V	2	18	
t_{PLH2}	$\overline{CLR}$ to Qn	C_L = 30pF	3.0V & 3.6V	5	21	ns
			4.5V & 5.5V	5	17	
		C_L = 50pF	3.0V & 3.6V	5	25	ns
			4.5V & 5.5V	5	21	
f_{MAX}	Maximum clock frequency	C_L = 50pF	3.0V, 4.5V, and 5.5V		83	MHz
t_{SU1}	Data setup time before CLK↑	C_L = 50pF	3.0V, 4.5V, and 5.5V	4		ns
t_{SU2}	$\overline{CLR}$ inactive Setup time before CLK ↑	C_L = 50pF	3.0V, 4.5V, and 5.5V	4		ns
t_H[3]	Data hold time after CLK ↑	C_L = 50pF	3.0V, 4.5V, and 5.5V	2		ns
t_W	Minimum pulse width $\overline{CLR}$ low CLK high CLK low	C_L = 50pF	3.0V, 4.5V, and 5.5V	6		ns

Notes:
1. Maximum allowable relative shift equals 50mV.
2. All specifications valid for radiation dose ≤ 1E6 rads(Si) per MIL-STD-883 Method 1019 Condition B.
3. Based on characterization, hold time (t_H) of 0ns can be assumed if data setup time (t_{SU1}) is ≥10ns. This is guaranteed, but not tested.

Packaging





PKG CONFIG	LEAD COUNT	MIL-STD 1835 DWG CONF B	DIMENSION SYMBOLS													
			A	b	c	D	E	E1	E2	E3	e	k	L	Q	S1
-03	14	F-2A	0.115 0.045	0.022 0.015	0.009 0.004	0.390 -----	0.260 0.235	0.290 -----	----- 0.130	----- 0.030	0.050 BSC	0.015 0.008	0.370 0.270	0.045 0.026	----- 0.005
-04	16	F-5A	0.115 0.045	0.022 0.015	0.009 0.004	0.440 -----	0.285 0.245	0.315 -----	----- 0.130	----- 0.030	0.050 BSC	0.015 0.008	0.370 0.250	0.045 0.026	----- 0.005
-05	20	F-9A	0.115 0.045	0.022 0.015	0.009 0.004	0.540 -----	0.300 0.245	0.330 -----	----- 0.130	----- 0.030	0.050 BSC	0.015 0.008	0.370 0.250	0.045 0.026	----- 0.000

Ordering Information UT54ACS164E/UT54ACTS164E

UT54 *** **** - * * *

Lead Finish: (Notes 1 & 2)
A = Solder
C = Gold
X = Optional

Screening: (Note 3)
C = Military Temperature Range (-55°C to +125°C)

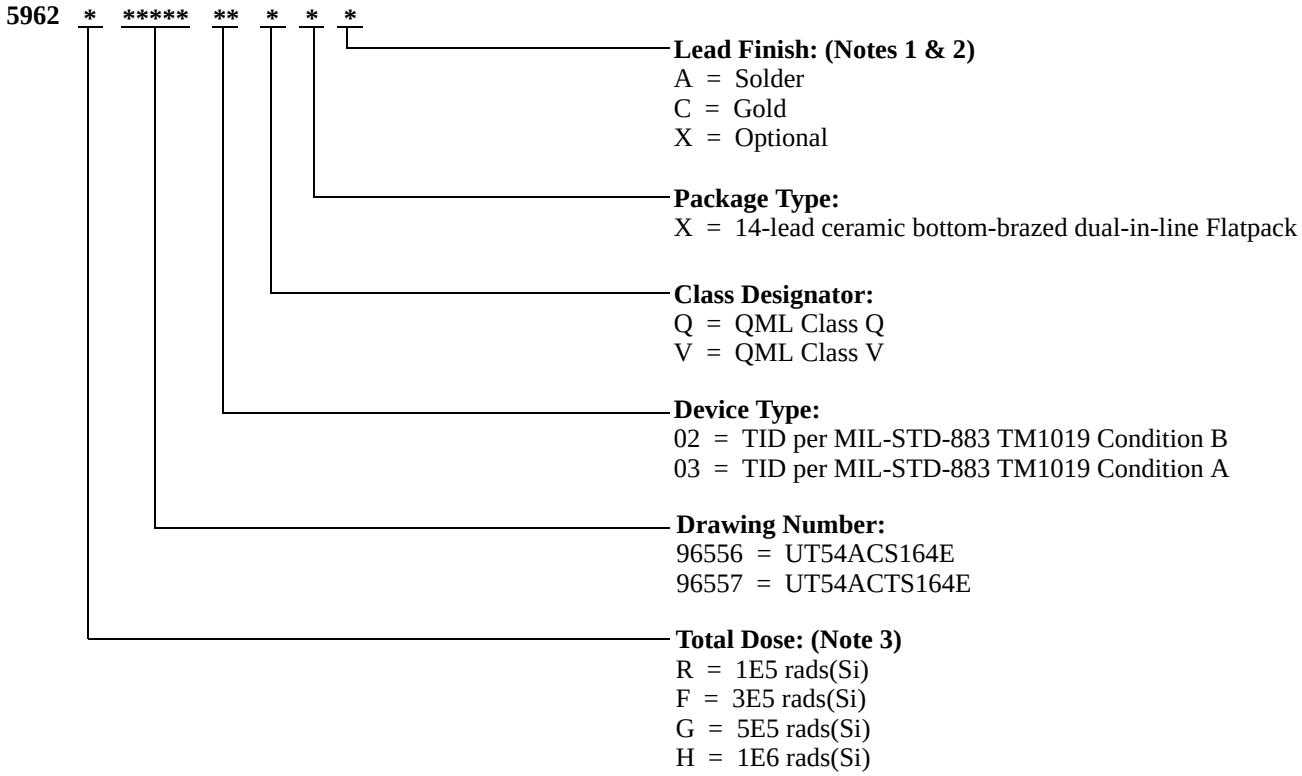
Package Type:
U = 14-lead ceramic bottom-brazed dual-in-line Flatpack

Part Number:
164E = 8-bit Shift Register

I/O Type:
ACS = CMOS compatible I/O level
ACTS = TTL compatible I/O level

Notes:
1. **Lead finish (A, C, or X) must be specified.**
2. **If an "X" is specified when ordering, then the part marking will match the lead finish and will be either "A" (solder) or "C" (gold).**
3. **Military Temperature Range flow per Aeroflex Manufacturing Flows Document. Devices have 48 hours of burn-in and are test at -55°C, room temperature, and 125°C. Radiation characterisitics are neither tested nor guaranteed and may not be specified.**

UT54ACS164E/UTACTS164E: SMD



Notes:

1. **Lead finish (A, C, or X) must be specified.**
2. **If an "X" is specified when ordering, then the 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 V is not available without radiation testing.**
4. **Total dose tolerance of 1E6 rads(Si) is only available for device type 02.**