

UT54ACS164E/UT54ACTS164E

Radiation-Hardened 8-Bit Shift Registers

January, 2004

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FEATURES

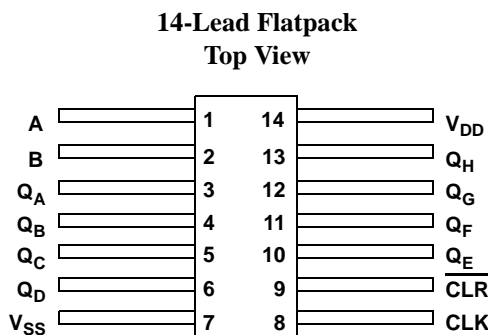
- AND-gated (enable/disable) serial inputs
- Fully buffered clock and serial inputs
- Direct clear
- 0.6µm CRH CMOS Process
- Latchup immune
- High speed
- Low power consumption
- Wide operating power supply from 3.0V to 5.5V
- Available QML Q or V processes
- 14-lead flatpack

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



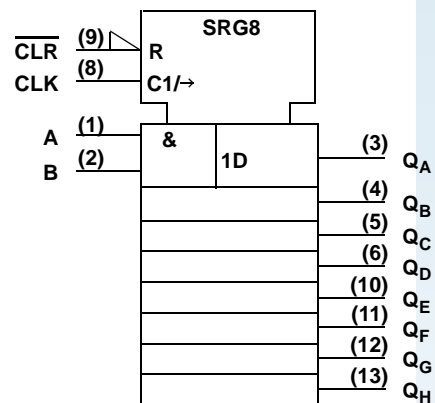
FUNCTION TABLE

INPUTS				OUTPUTS		
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.

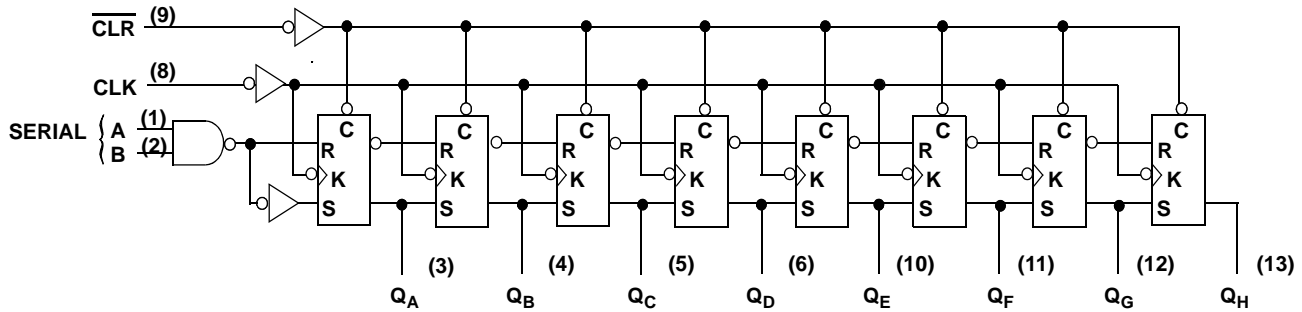
LOGIC SYMBOL



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:

- Logic will not latchup during radiation exposure within the limits defined in the table.
- 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:

- 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 UT54ACS164E⁷

($V_{DD} = 3.0V$ to $5.5V$; $V_{SS} = 0V$ ⁶; $-55^{\circ}C < T_C < +125^{\circ}C$)

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	$I_{OL} = 100\mu A$	3.0V		0.25	V
			4.5V		0.25	
V_{OH}	High-level output voltage ³	$I_{OH} = -100\mu A$	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} $V_{OL} = 0.4V$	3.0V	6		mA
			5.5V	8		
I_{OH}	High level output current ⁹	$V_{IN} = V_{DD}$ or V_{SS} $V_{OH} = V_{DD}-0.4V$	3.0V		-6	mA
			5.5V		-8	
P_{total}	Power dissipation ^{2, 8}	$C_L = 50pF$	5.5V		1.9	mW/ MHz
			3.0V		0.76	
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:**
- 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 $V_{IL}(\max)$.
 - Supplied as a design limit but not guaranteed or tested.
 - Per MIL-PRF-38535, for current density $\leq 5.0E5$ amps/cm², the maximum product of load capacitance (per output buffer) times frequency should not exceed 3,765pF/MHz.
 - Not more than one output may be shorted at a time for maximum duration of one second.
 - 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.
 - Maximum allowable relative shift equals 50mV.
 - All specifications valid for radiation dose $\leq 1E6$ rads(Si) per MIL-STD-883 Method 1019 Condition B.
 - Power dissipation specified per switching output.
 - This value is guaranteed based on characterization data, but not tested.

AC ELECTRICAL CHARACTERISTICS FOR THE UT54ACS164E²

($V_{DD} = 3.0V$ to $5.5V$; $V_{SS} = 0V$ ¹, $-55^{\circ}C < T_C < +125^{\circ}C$)

SYMBOL	PARAMETER	CONDITION	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 \uparrow	$C_L = 50pF$	3.0V, 4.5V, and 5.5V	4		ns
t_{SU2}	\overline{CLR} inactive Setup time before CLK \uparrow	$C_L = 50pF$	3.0V, 4.5V, and 5.5V	4		ns
t_H^3	Data hold time after CLK \uparrow	$C_L = 50pF$	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 $\leq 1E6$ 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 ≥ 10 ns. This is guaranteed, but not tested.

DC ELECTRICAL CHARACTERISTICS FOR THE UT54ACTS164E⁷

($V_{DD} = 3.0V$ to $5.5V$; $V_{SS} = 0V^6$; $-55^{\circ}C < T_C < +125^{\circ}C$)

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	$I_{OH} = -6mA$	3.0V	2.4		V
		$I_{OH} = -8mA$	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} $V_{OL} = 0.4V$	3.0V	6		mA
			5.5V	8		
I_{OH}	High level output current ¹⁰	$V_{IN} = V_{DD}$ or V_{SS} $V_{OH} = V_{DD} - 0.4V$	3.0V		-6	mA
			5.5V		-8	
P_{total}	Power dissipation ^{2,8,9}	$C_L = 50pF$	5.5V		1.9	mW/ MHz
			3.0V		0.76	
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:

- 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 $V_{IL(max)}$.
- Supplied as a design limit but not guaranteed or tested.
- Per MIL-PRF-38535, for current density $\leq 5.0E5$ amps/cm², the maximum product of load capacitance (per output buffer) times frequency should not exceed 3,765pF/MHz.
- Not more than one output may be shorted at a time for maximum duration of one second.
- 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.
- Maximum allowable relative shift equals 50mV.
- All specifications valid for radiation dose $\leq 1E6$ rads(Si) per MIL-STD-883 Method 1019 Condition B.
- Power does not include power contribution of any TTL output sink current
- Power dissipation specified per switching output.
- This value is guaranteed based on characterization data, but not tested.

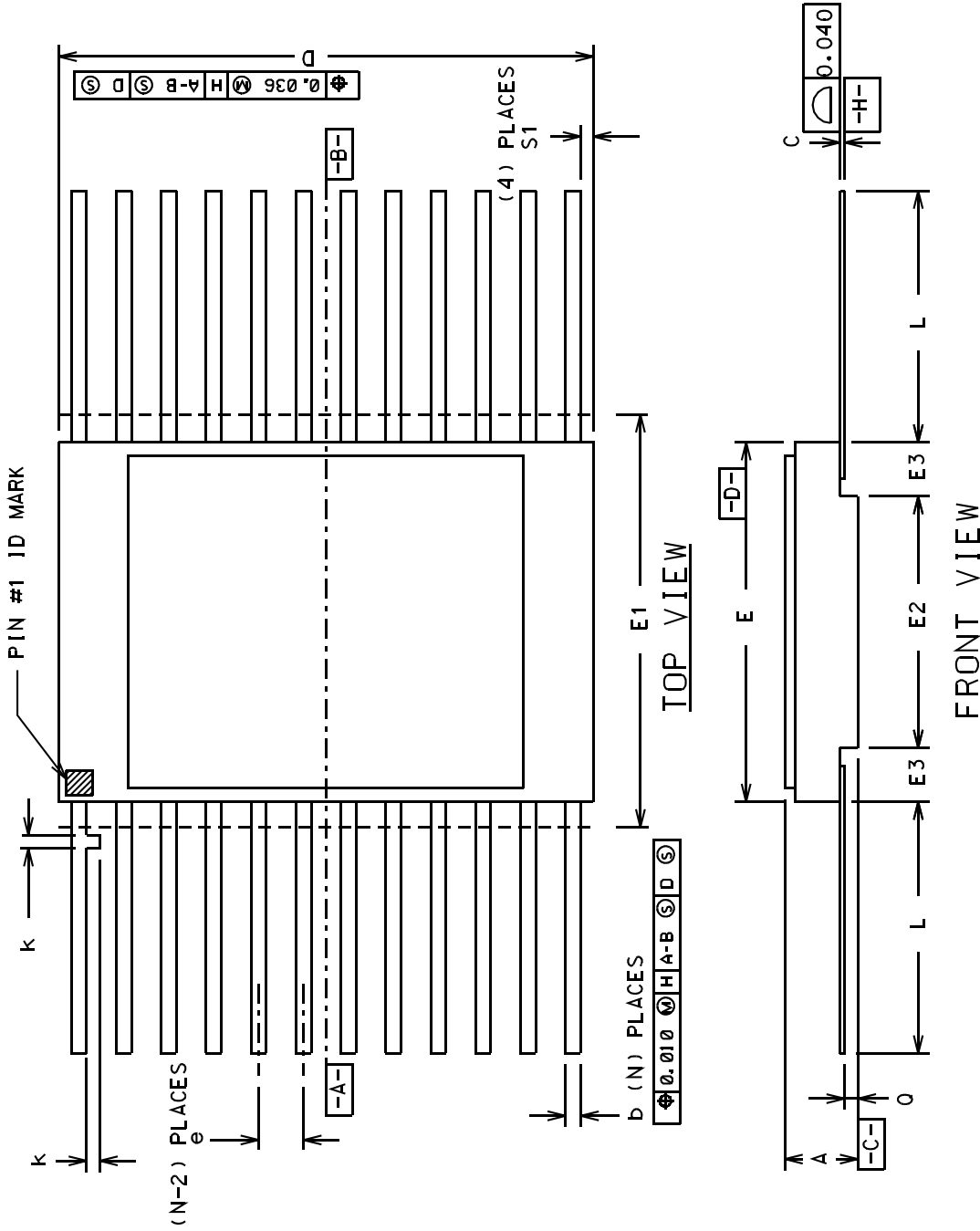
AC ELECTRICAL CHARACTERISTICS FOR THE UT54ACTS164E²

($V_{DD} = 3.0V$ to $5.5V$; $V_{SS} = 0V$ ¹, $-55^{\circ}C < T_C < +125^{\circ}C$)

SYMBOL	PARAMETER	CONDITION	V_{DD}	MINIMUM	MAXIMUM	UNIT
t_{PHL1}	CLK to Qn	$C_L = 30pF$	3.0V & 3.6V	4	21	ns
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		$C_L = 50pF$	3.0V & 3.6V	4	25	ns
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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 \uparrow	$C_L = 50pF$	3.0V, 4.5V, and 5.5V	4		ns
t_{SU2}	\overline{CLR} inactive Setup time before CLK \uparrow	$C_L = 50pF$	3.0V, 4.5V, and 5.5V	4		ns
t_H^3	Data hold time after CLK \uparrow	$C_L = 50pF$	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

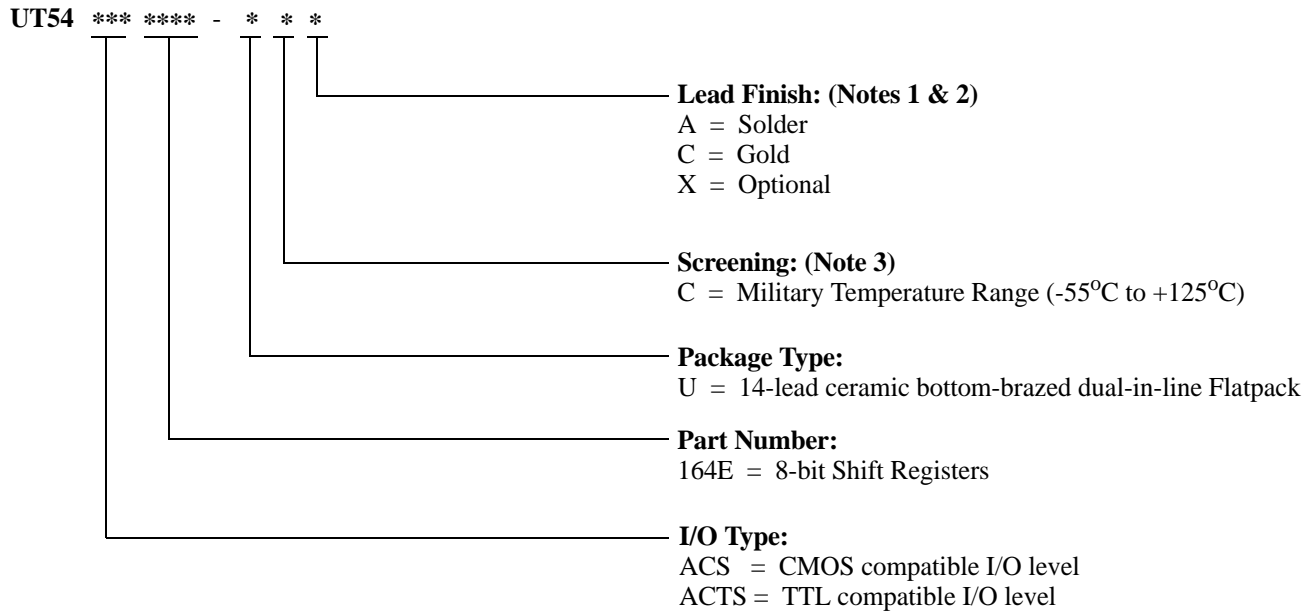
Notes:

1. Maximum allowable relative shift equals 50mV.
2. All specifications valid for radiation dose $\leq 1E6$ 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 ≥ 10 ns. This is guaranteed, but not tested.



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

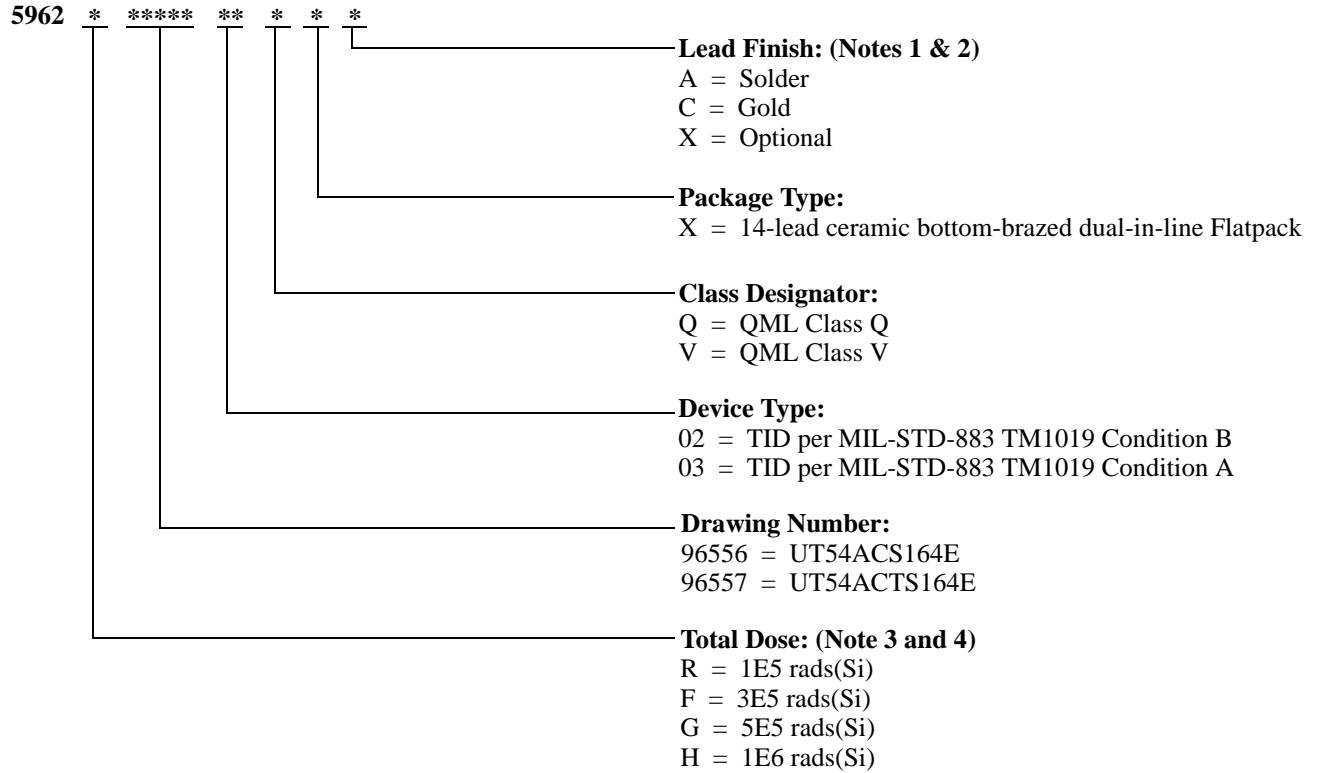
Ordering Information UT54ACS164E/UT54ACTS164E



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 characteristics 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. 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 B. 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.

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Our passion for performance is defined by three attributes represented by these three icons: solution-minded, performance-driven and customer-focused