

UT54ACS165E

Radiation-Hardened

8-Bit Parallel Shift Registers

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FEATURES

- Complementary outputs
- Direct overriding load (data) inputs
- Gated clock inputs
- Parallel-to-serial data conversions
- 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
- 16-lead flatpack

DESCRIPTION

The UT54ACS165E is an 8-bit serial shift register that, when clocked, shifts the data toward serial output Q_H . Parallel-in access to each stage is provided by eight individual data inputs that are enabled by a low level at the $\overline{SH/LD}$ input. The devices feature a clock inhibit function and a complemented serial output \overline{Q}_H .

Clocking is accomplished by a low-to-high transition of the CLK input while $\overline{SH/LD}$ is held high and CLK INH is held low. The functions of the CLK and CLK INH (clock inhibit) inputs are interchangeable. Since a low CLK input and a low-to-high transition of CLK INH will also accomplish clocking, CLK INH should be changed to the high level only while the CLK input is high. Parallel loading is disabled when $\overline{SH/LD}$ is held high. Parallel inputs to the registers are enabled while $\overline{SH/LD}$ is low independently of the levels of CLK, CLK INH or SER inputs.

The device is characterized over the full military temperature range of -55°C to +125°C.

PINOUT

16-Lead Flatpack Top View

$\overline{SH/LD}$	1	16	V_{DD}
CLK	2	15	CLK INH
E	3	14	D
F	4	13	C
G	5	12	B
H	6	11	A
\overline{Q}_H	7	10	SER
V_{SS}	8	9	Q_H

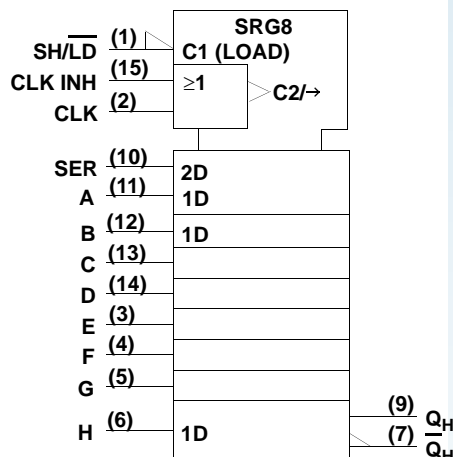
FUNCTION TABLE

INPUTS					INTERNAL OUTPUTS		OUTPUTS	
$\overline{SH/LD}$	CLK INH	CLK	SER	PARALLEL A ... H	\overline{Q}_A	\overline{Q}_B	Q_H	\overline{Q}_H
L	X	X	X	a ... h	a	b	h	\overline{h}
H	L	L	X	X	Q_A	Q_B	Q_H	\overline{Q}_H
H	L	↑	H	X	H	Q_A	Q_G	\overline{Q}_G
H	L	↑	L	X	L	Q_A	Q_G	\overline{Q}_G
H	H	X	X	X	Q_A	Q_B	Q_H	\overline{Q}_H

Note:

1. Q_n = The state of the referenced output one setup time prior to the Low-to-High clock transition.

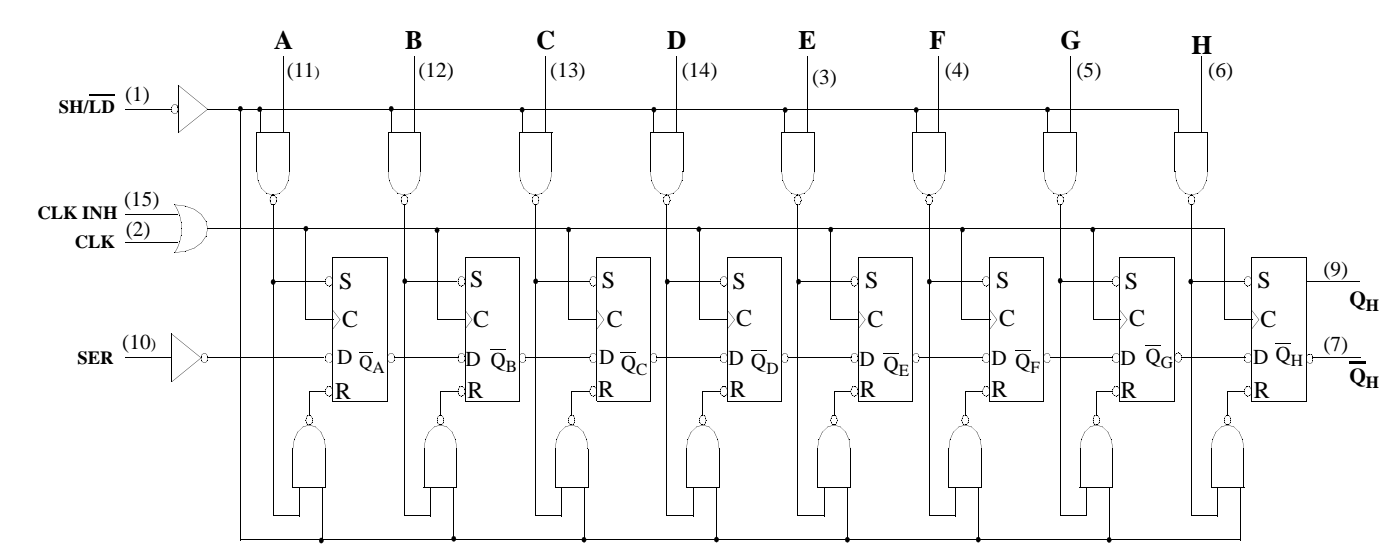
LOGIC SYMBOL



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 UT54ACS165E⁷

($V_{DD} = 3.0V$ 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		2.9	mW/ MHz
			3.0V		1.16	
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 UT54ACS165E²

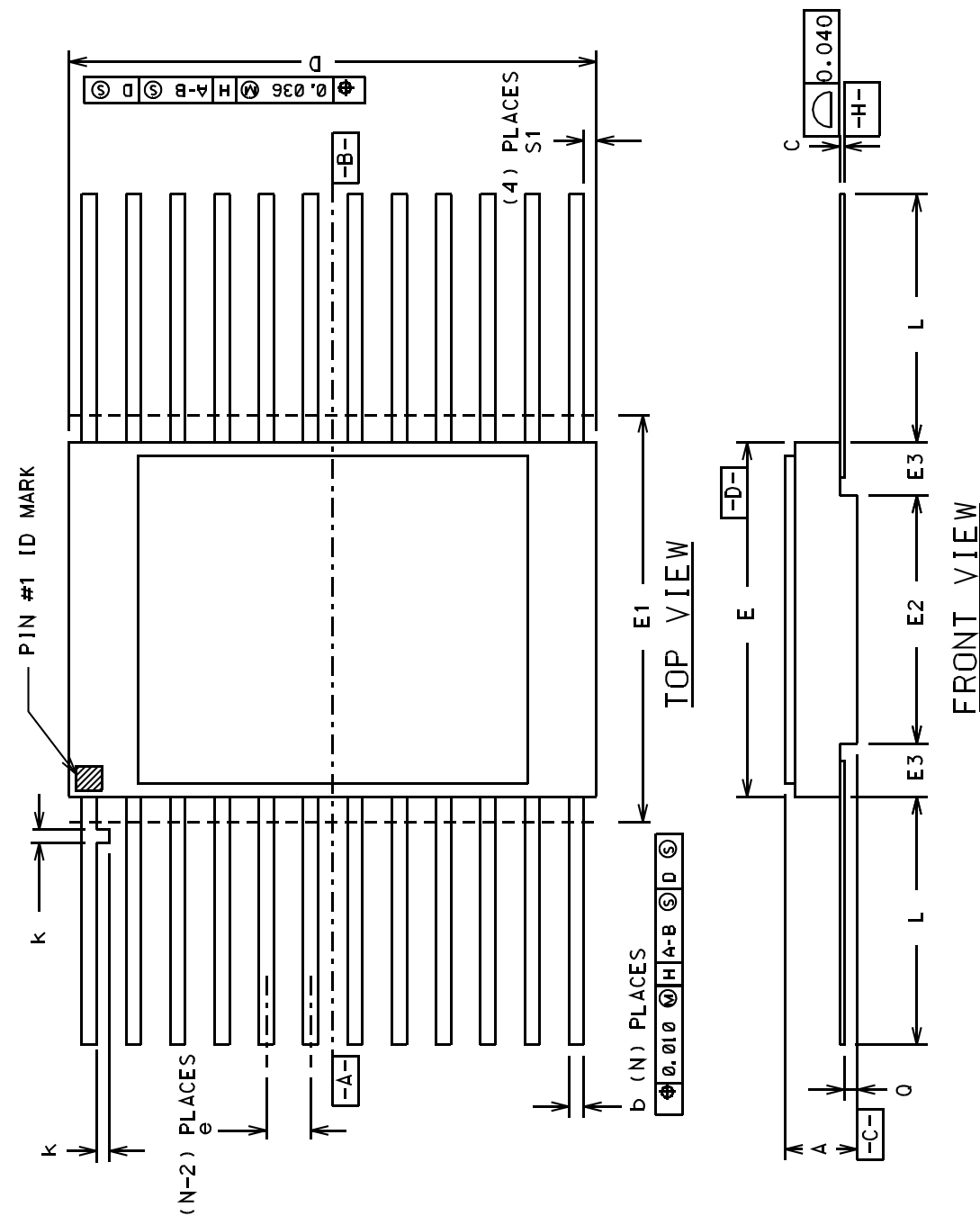
(V_{DD} = 3.0V to 5.5V; V_{SS} = 0V¹, -55°C < T_C < +125°C)

SYMBOL	PARAMETER	CONDITION	V _{DD}	MINIMUM	MAXIMUM	UNIT
t _{PLH1}	CLK or CLKINH to Q _H or \overline{Q}_H	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 _{PHL1}	CLK or CLKINH to Q _H or \overline{Q}_H	C _L = 30pF	3.0V & 3.6V	2	21	ns
			4.5V & 5.5V	2	17	
		C _L = 50pF	3.0V & 3.6V	2	25	ns
			4.5V & 5.5V	2	21	
t _{PLH2}	SH/ \overline{LD} to Q _H or \overline{Q}_H	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 _{PHL2}	SH/ \overline{LD} to Q _H or \overline{Q}_H	C _L = 30pF	3.0V & 3.6V	2	21	ns
			4.5V & 5.5V	2	17	
		C _L = 50pF	3.0V & 3.6V	2	25	ns
			4.5V & 5.5V	2	21	
t _{PLH3}	H to Q _H	C _L = 30pF	3.0V & 3.6V	2	17	ns
			4.5V & 5.5V	2	13	
		C _L = 50pF	3.0V & 3.6V	2	21	ns
			4.5V & 5.5V	2	17	
t _{PHL3}	H to Q _H	C _L = 30pF	3.0V & 3.6V	2	21	ns
			4.5V & 5.5V	2	17	
		C _L = 50pF	3.0V & 3.6V	2	25	ns
			4.5V & 5.5V	2	21	
t _{PLH4}	H to \overline{Q}_H	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 _{PLH4}	H to \overline{Q}_H	C _L = 30pF	3.0V & 3.6V	2	20	ns
			4.5V & 5.5V	2	16	
		C _L = 50pF	3.0V & 3.6V	2	24	ns
			4.5V & 5.5V	2	20	

SYMBOL	PARAMETER	CONDITION	V _{DD}	MINIMUM	MAXIMUM	UNIT
f _{MAX}	Maximum clock frequency	C _L = 50pF	3.0V, 4.5V, and 5.5V		71	MHz
t _{SU1}	SER, SH/ $\overline{\text{LD}}$, CLKINH or CLK Setup time before CLK \uparrow or CLKINH \uparrow	C _L = 50pF	3.0V, 4.5V, and 5.5V	7		ns
t _{SU2}	Data setup time before SH/ $\overline{\text{LD}}$	C _L = 50pF	3.0V, 4.5V, and 5.5V	7		ns
t _{H1}	SER hold time after CLK or CLKINH \uparrow	C _L = 50pF	3.0V, 4.5V, and 5.5V	2		ns
t _{H2}	CLKINH \uparrow hold time after CLK	C _L = 50pF	3.0V, 4.5V, and 5.5V	2		ns
t _{H3} ³	Hold time for any input after SH/ $\overline{\text{LD}}$	C _L = 50pF	3.0V, 4.5V, and 5.5V	2		ns
t _W	Minimum pulse width CLK or CLKINH high CLK or CLKINH low SH/ $\overline{\text{LD}}$	C _L = 50pF	3.0V, 4.5V, and 5.5V	7		ns

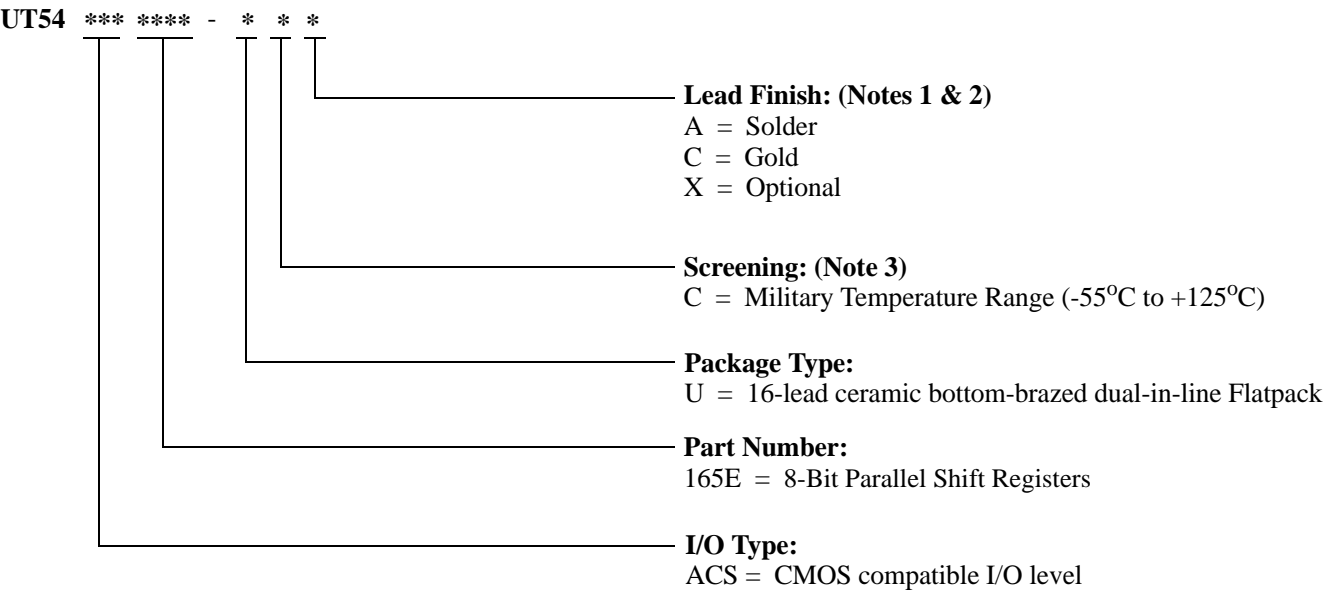
Notes:

1. Maximum allowable relative shift equals 50mV.
2. All specifications valid for radiation dose $\leq 1\text{E6}$ rads(Si) per MIL-STD-883 Method 1019 Condition B.
3. Based on characterization, hold time (t_{H3}) of 0ns for data pins A-H, can be assumed if data setup time (t_{SU2}) is $\geq 10\text{ns}$. This is guaranteed, but not tested.



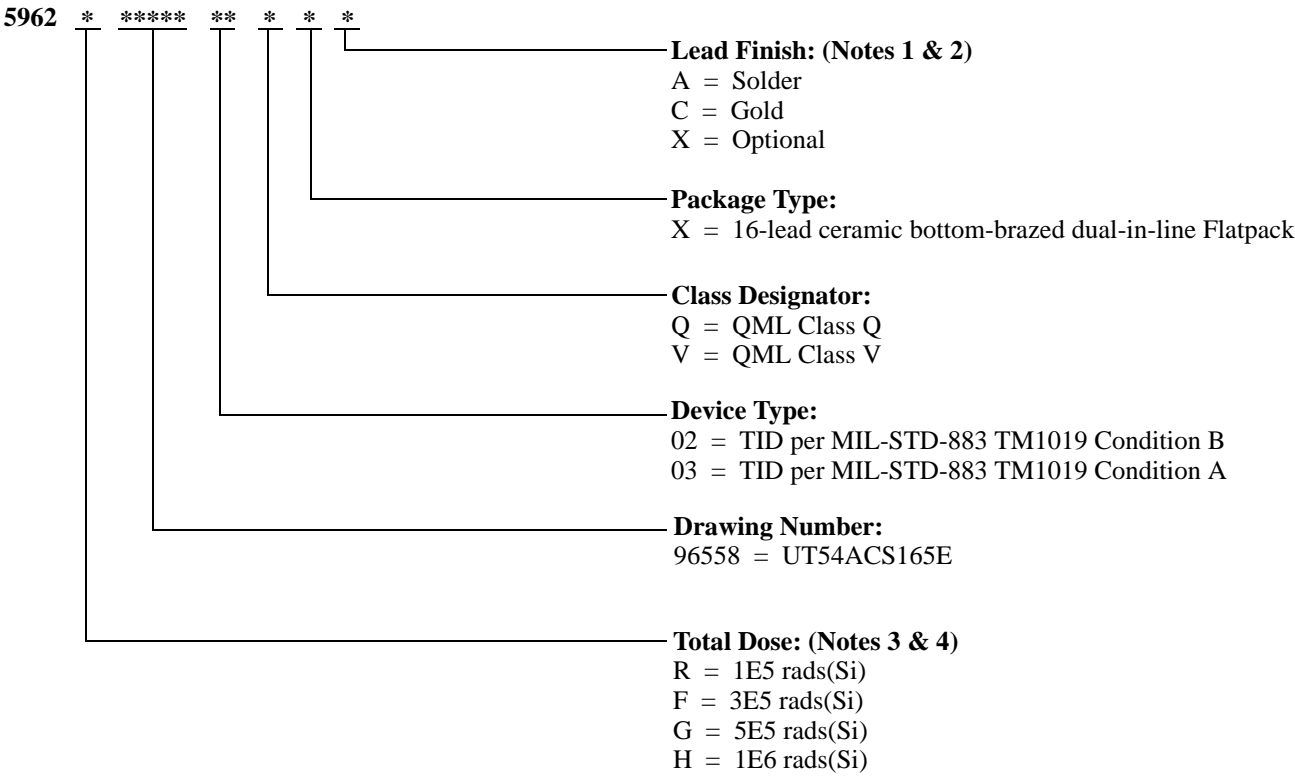
PKG CONF1G	LEAD COUNT	MIL-STD 1835 DWG CONF B	DIMENSION SYMBOLS													
			A	b	c	D	E	E1	E2	E3	e	k	L	O	S1	
-03	14	F-2A	0.115 0.045	0.022 0.015	0.009 0.004	0.390 -----	0.260 0.235	0.290 -----	----- 0.130	----- 0.030	0.050 BSC	0.015 0.008	0.370 0.270	0.045 0.026	----- 0.005	
-04	16	F-5A	0.115 0.045	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 UT54ACS165E



- 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.

UT54ACS165E: 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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