

# UT54ACS193/UT54ACTS193

## Synchronous 4-Bit Up-Down Dual Clock Counters

Datasheet

November 2010

www.aeroflex.com/logic



### FEATURES

- ❑ Look-ahead circuitry enhances cascaded counters
- ❑ Fully synchronous in count modes
- ❑ Parallel asynchronous load for modulo-N count lengths
- ❑ Asynchronous clear
- ❑ 1.2μ CMOS (ACTS193) and .6μm CRH CMOS process (ACS193)
  - Latchup immune
- ❑ High speed
- ❑ Low power consumption
- ❑ Single 5 volt supply
- ❑ Available QML Q or V processes
- ❑ Flexible package
  - 16-pin DIP
  - 16-lead flatpack
- ❑ UT54ACS193 - SMD 5962-96566
- ❑ UT54ACTS193 - SMD 5962-96567

### DESCRIPTION

The UT54ACS193 and the UT54ACTS193 are synchronous 4-bit, binary reversible up-down binary counters. Synchronous operation is provided by having all flip-flops clocked simultaneously so that the outputs change coincident with each other when instructed. Synchronous operation eliminates the output counting spikes normally associated with asynchronous counters.

The outputs of the four flip-flops are triggered on a low-to-high-level transition of either count input (Up or Down). The direction of the counting is determined by which count input is pulsed while the other count input is high.

The counters are fully programmable. The outputs may be preset to either level by placing a low on the load input and entering the desired data at the data inputs. The output will change to agree with the data inputs independently of the count pulses. Asynchronous loading allows the counters to be used as modulo-N dividers by simply modifying the count length with the preset inputs.

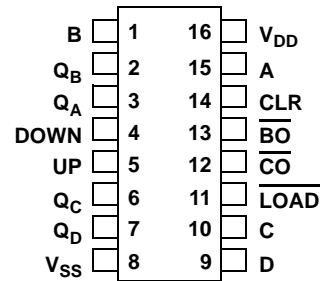
A clear input has been provided that forces all outputs to the low level when a high level is applied. The clear function is independent of the count and the load inputs.

The counter is designed for efficient cascading without the need for external circuitry. The borrow output ( $\overline{BO}$ ) produces a low-level pulse while the count is zero and the down input is low.

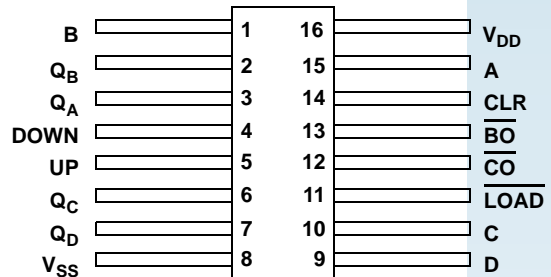
Similarly, the carry output ( $\overline{CO}$ ) produces a low-level pulse while the count is maximum

### PINOUTS

16-Pin DIP  
Top View



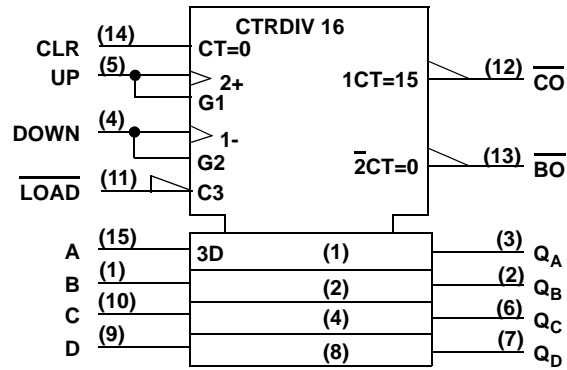
16-Lead Flatpack  
Top View



### FUNCTION TABLE

FUNCTION	CLOCK UP	CLOCK DOWN	CLR	LOAD
Count Up	↑	H	L	H
Count Down	H	↑	L	H
Reset	X	X	H	X
Load Preset Input	X	X	L	L

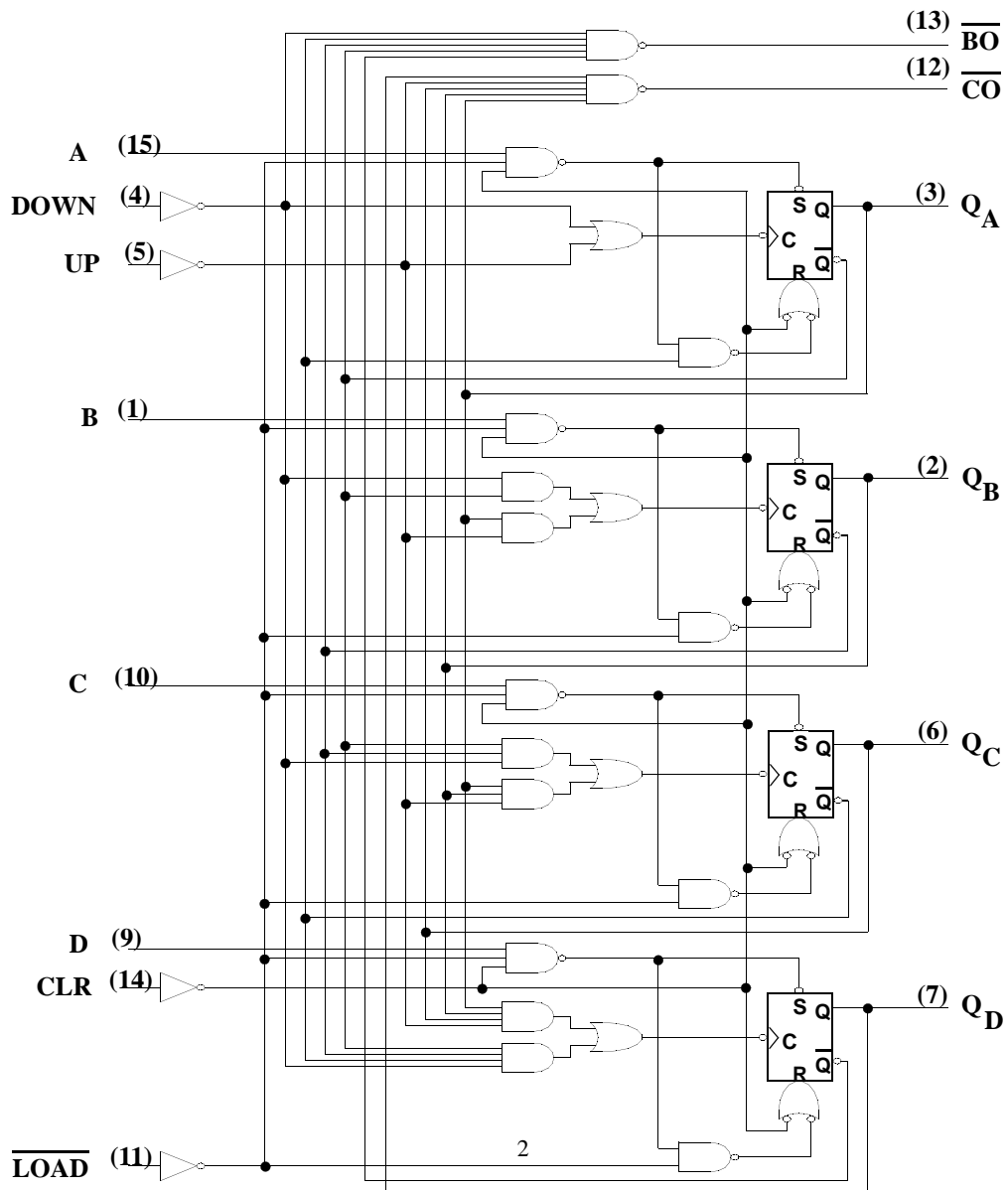
## LOGIC SYMBOL



**Note:**

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

## LOGIC DIAGRAM



## OPERATIONAL ENVIRONMENT<sup>1</sup>

PARAMETER	LIMIT	UNITS
Total Dose	1.0E6	rads(Si)
SEU Threshold <sup>2</sup>	80	MeV-cm <sup>2</sup> /mg
SEL Threshold	120	MeV-cm <sup>2</sup> /mg
Neutron Fluence	1.0E14	n/cm <sup>2</sup>

### 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 <sub>DD</sub>	Supply voltage	-0.3 to 7.0	V
V <sub>I/O</sub>	Voltage any pin	-.3 to V <sub>DD</sub> +.3	V
T <sub>STG</sub>	Storage Temperature range	-65 to +150	°C
T <sub>J</sub>	Maximum junction temperature	+175	°C
T <sub>LS</sub>	Lead temperature (soldering 5 seconds)	+300	°C
Θ <sub>JC</sub>	Thermal resistance junction to case	20	°C/W
I <sub>I</sub>	DC input current	±10	mA
P <sub>D</sub>	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 <sub>DD</sub>	Supply voltage	4.5 to 5.5	V
V <sub>IN</sub>	Input voltage any pin	0 to V <sub>DD</sub>	V
T <sub>C</sub>	Temperature range	-55 to + 125	°C

## DC ELECTRICAL CHARACTERISTICS <sup>7</sup>

( $V_{DD} = 5.0V \pm 10\%$ ;  $V_{SS} = 0V$  <sup>6</sup>,  $-55^{\circ}C < T_C < +125^{\circ}C$ ); Unless otherwise noted,  $T_c$  is per the temperature range ordered.

SYMBOL	PARAMETER	CONDITION	MIN	MAX	UNIT
$V_{IL}$	Low-level input voltage <sup>1</sup> ACTS ACS			0.8 .3 $V_{DD}$	V
$V_{IH}$	High-level input voltage <sup>1</sup> ACTS ACS		.5 $V_{DD}$ .7 $V_{DD}$		V
$I_{IN}$	Input leakage current ACTS/ACS	$V_{IN} = V_{DD}$ or $V_{SS}$	-1	1	$\mu A$
$V_{OL}$	Low-level output voltage <sup>3</sup> ACTS ACS	$I_{OL} = 8.0mA$ $I_{OL} = 100\mu A$		0.40 0.25	V
$V_{OH}$	High-level output voltage <sup>3</sup> ACTS ACS	$I_{OH} = -8.0mA$ $I_{OH} = -100\mu A$	.7 $V_{DD}$ $V_{DD} - 0.25$		V
$I_{OS}$	Short-circuit output current <sup>2,4</sup> ACTS/ACS	$V_O = V_{DD}$ and $V_{SS}$	-200	200	mA
$I_{OL}$	Output current <sup>10</sup> (Sink)	$V_{IN} = V_{DD}$ or $V_{SS}$ $V_{OL} = 0.4V$	8		mA
$I_{OH}$	Output current <sup>10</sup> (Source)	$V_{IN} = V_{DD}$ or $V_{SS}$ $V_{OH} = V_{DD} - 0.4V$	-8		mA
$P_{total}$	Power dissipation <sup>2, 8, 9</sup>	$C_L = 50pF$		2.1	mW/ MHz
$I_{DDQ}$	Quiescent Supply Current	$V_{DD} = 5.5V$		10	$\mu A$
$\Delta I_{DDQ}$	Quiescent Supply Current Delta ACTS	For input under test $V_{IN} = V_{DD} - 2.1V$ For all other inputs $V_{IN} = V_{DD}$ or $V_{SS}$ $V_{DD} = 5.5V$		1.6	mA
$C_{IN}$	Input capacitance <sup>5</sup>	$f = 1MHz @ 0V$		15	pF
$C_{OUT}$	Output capacitance <sup>5</sup>	$f = 1MHz @ 0V$		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  $\leq 5.0E5$  amps/cm<sup>2</sup>, the maximum product of load capacitance (per output buffer) times frequency should not exceed 3,765 pF/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 ACTS specifications are valid for radiation dose  $\leq 1E6$  rads(Si) and all ACS specifications are valid for radiation dose  $\leq 5E5$  rads(Si).
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 <sup>2</sup>

( $V_{DD} = 5.0V \pm 10\%$ ;  $V_{SS} = 0V$  <sup>6</sup>,  $-55^{\circ}C < T_C < +125^{\circ}C$ ); Unless otherwise noted,  $T_c$  is per the temperature range ordered.

SYMBOL	PARAMETER	MINIMUM	MAXIMUM	UNIT
$t_{PLH}$	UP to $Q_n$	2	20	ns
$t_{PHL}$	UP to $Q_n$	2	24	ns
$t_{PLH}$	UP to $\overline{CO}$	2	13	ns
$t_{PHL}$	UP to $\overline{CO}$	2	16	ns
$t_{PLH}$	DOWN to $\overline{BO}$	2	13	ns
$t_{PHL}$	DOWN to $\overline{BO}$	2	16	ns
$t_{PLH}$	DOWN to $Q_n$	2	20	ns
$t_{PHL}$	DOWN to $Q_n$	2	24	ns
$t_{PLH}$	$\overline{LOAD}$ to $Q_n$	2	22	ns
$t_{PHL}$	$\overline{LOAD}$ to $Q_n$	2	23	ns
$t_{PHL}$	CLR to $Q_n$	2	22	ns
$f_{MAX}$	Maximum clock frequency		56	MHz
$t_{SU1}$	$\overline{LOAD}$ inactive setup time before UP or DOWN $\uparrow$	3		ns
$t_{SU2}$	CLR inactive setup time before UP or DOWN $\uparrow$	3		ns
$t_{SU3}$	A, B, C, D setup time before $\overline{LOAD}$ $\uparrow$	6		ns
$t_{H1}$	UP high hold time after DOWN $\uparrow$	20		ns
$t_{H2}$	DOWN high hold time after UP $\uparrow$	20		ns
$t_{H3}$ <sup>3</sup>	A, B, C, D hold time after $\overline{LOAD}$ $\uparrow$	2		ns
$t_w$	Minimum pulse width UP high or low DOWN high or low $\overline{LOAD}$ low CLR high	9		ns

### Notes:

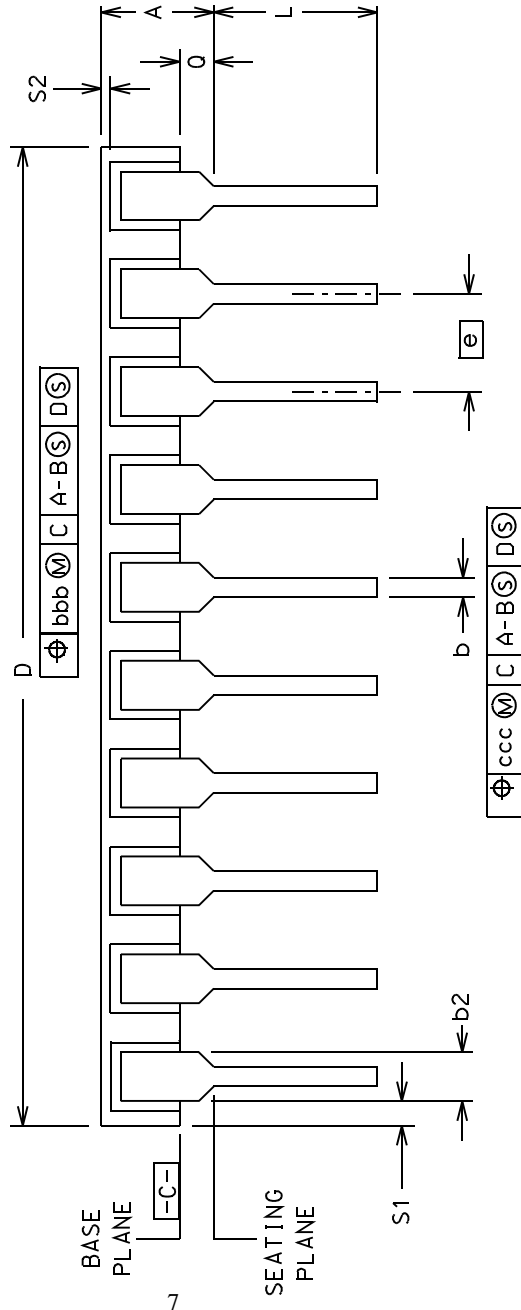
1. Maximum allowable relative shift equals 50mV.
2. All ACTS specifications are valid for radiation dose  $\leq 1E6$  rads(Si) and all ACS specifications are valid for radiation dose  $\leq 5E5$  rads(Si).
3. Based on characterization, data hold time ( $t_{H3}$ ) of 0ns can be assumed if data setup time ( $t_{SU3}$ ) is  $\geq 10$ ns. This is guaranteed, but not tested.

# PACKAGING

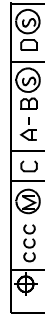
## Side-Brazed Packages



SIDE VIEW

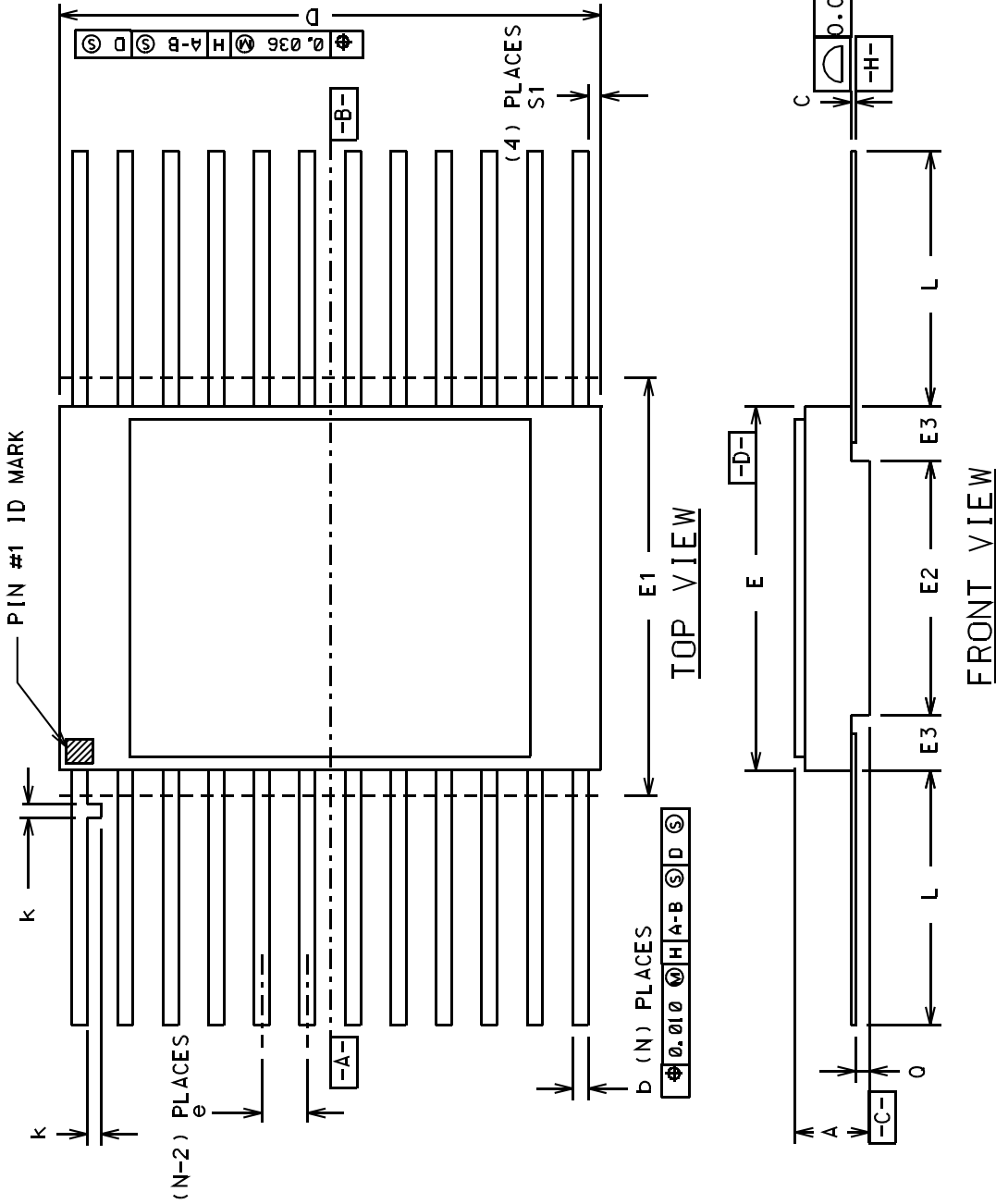


FRONT VIEW



PKG CONFIG	LEAD COUNT	MIL-STD-1835 DWG CONF C	DIMENSION SYMBOLS														
			A	b	b2	c	D	E	e	eA	L	Q	S1	S2	aaa	bbb	ccc
-01	14	D-1	0.200	0.026	0.065	0.018	0.785	0.310	0.100	0.300	0.200	0.060	---	---	0.015	0.030	0.010
-02	16	D-2	0.200	0.014	0.045	0.008	---	0.220	BSC	BSC	0.125	0.015	0.005	---	---	---	---
-03	20	D-8	0.200	0.026	0.065	0.018	0.840	0.310	0.100	0.300	0.200	0.060	---	---	0.015	0.030	0.010
			---	0.014	0.045	0.008	---	0.220	BSC	BSC	0.125	0.015	0.005	---	---	---	---
			0.200	0.026	0.065	0.018	1.060	0.310	0.100	0.300	0.200	0.070	---	---	0.015	0.030	0.010
			---	0.014	0.045	0.008	---	0.220	BSC	BSC	0.125	0.015	0.005	---	---	---	---

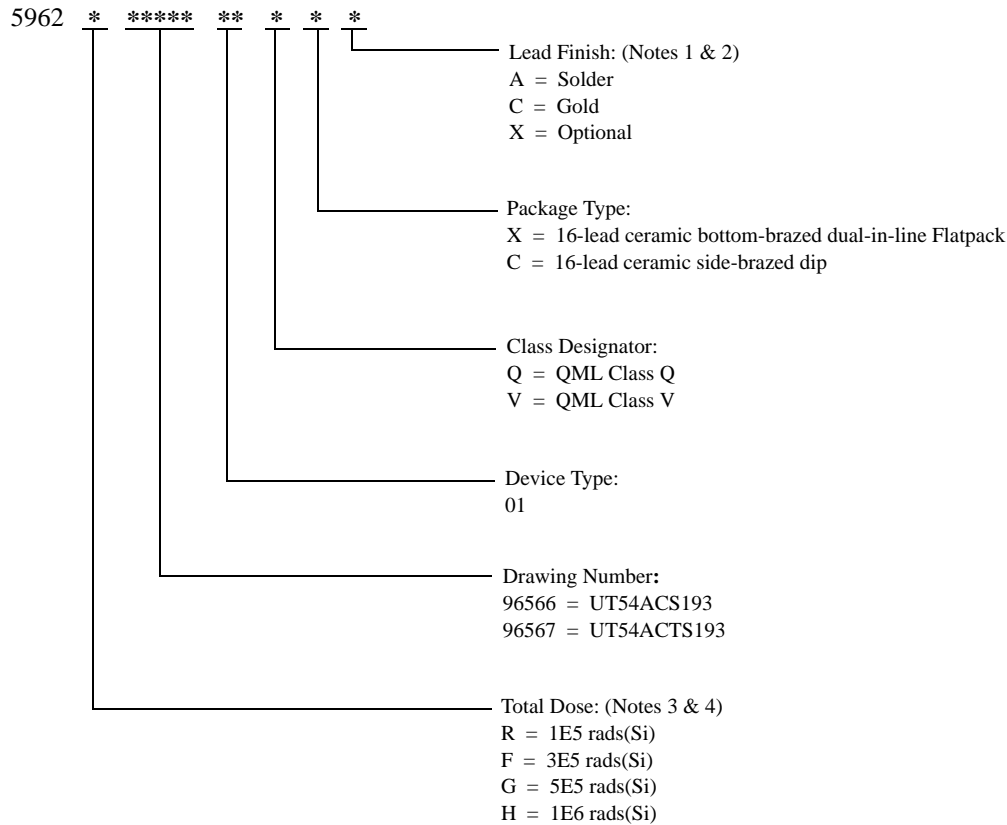
# FLATPACK PACKAGES



PKG CONFIG	LEAD COUNT	MIL-STD 1835 DWG CONF B	DIMENSION SYMBOLS												
			A	b	c	D	E	E1	E2	E3	e	k	L	0	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



**UT54ACS193/UT54ACTS193: SMD**



**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 Q and QML V not available without radiation hardening. For prototype 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.

# *Aeroflex Colorado Springs - Datasheet Definition*

**Advanced Datasheet - Product In Development**

**Preliminary Datasheet - Shipping Prototype**

**Datasheet - Shipping QML & Reduced Hi-Rel**

**COLORADO**

Toll Free: 800-645-8862  
Fax: 719-594-8468

**INTERNATIONAL**

Tel: 805-778-9229  
Fax: 805-778-1980

**NORTHEAST**

Tel: 603-888-3975  
Fax: 603-888-4585

**SE AND MID-ATLANTIC**

Tel: 321-951-4164  
Fax: 321-951-4254

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Fax: 949-362-2266

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Fax: 719-594-8468

*[www.aeroflex.com](http://www.aeroflex.com)      [info-ams@aeroflex.com](mailto:info-ams@aeroflex.com)*



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