

UT54ACS190/UT54ACTS190

Synchronous 4-Bit Up-Down BCD Counters

Datasheet

November 2010

www.aeroflex.com/logic



FEATURES

- ❑ Single down/up count control line
- ❑ Look-ahead circuitry enhances speed of cascaded counters
- ❑ Fully synchronous in count modes
- ❑ Asynchronously presettable with load control
- ❑ 1.2μ CMOS
 - 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
- ❑ UT54ACS190 - SMD 5962-96562
- ❑ UT54ACTS190 - SMD 5962-96563

DESCRIPTION

The UT54ACS190 and the UT54ACTS190 are synchronous 4-bit reversible up-down BCD decade counters. Synchronous counting operation is provided by having all flip-flops clocked simultaneously so that the outputs change coincident with each other when so instructed. Synchronous operation eliminates the output counting spikes associated with asynchronous counters.

The outputs of the four flip-flops are triggered on a low-to-high-level transition of the clock input if the enable input ($\overline{\text{CTEN}}$) is low. A logic one applied to $\overline{\text{CTEN}}$ inhibits counting. The direction of the count is determined by the level of the down/up ($\text{D}/\overline{\text{U}}$) input. When $\text{D}/\overline{\text{U}}$ is low, the counter counts up and when $\text{D}/\overline{\text{U}}$ is high, it counts down.

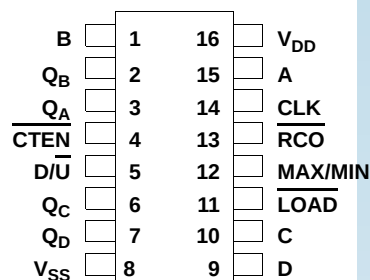
The counters feature a fully independent clock circuit. Changes at control inputs ($\overline{\text{CTEN}}$ and $\text{D}/\overline{\text{U}}$) that will modify the operating mode have no effect on the contents of the counter until clocking occurs.

The counters are fully programmable. The outputs may be preset to either logic 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 level of the clock input. The asynchronous load allows counters to be used as modulo-N dividers by simply modifying the count length with the preset inputs.

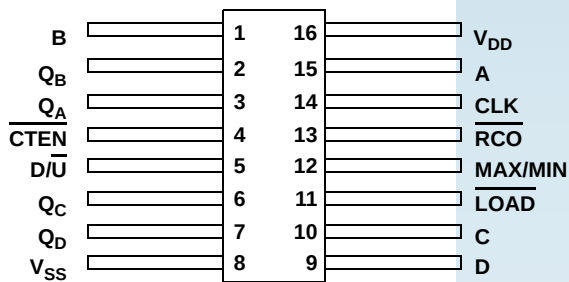
If preset to an illegal state, the counter returns to a normal sequence in one or two counts.

PINOUTS

16-Pin DIP Top View



16-Lead Flatpack Top View



Two outputs have been made available to perform the cascading function: ripple clock and maximum/minimum (MAX/MIN) count. The MAX/MIN output produces a high-level output pulse with a duration approximately equal to one complete cycle of the clock while the count is zero (all outputs low) counting down or maximum (9) counting up.

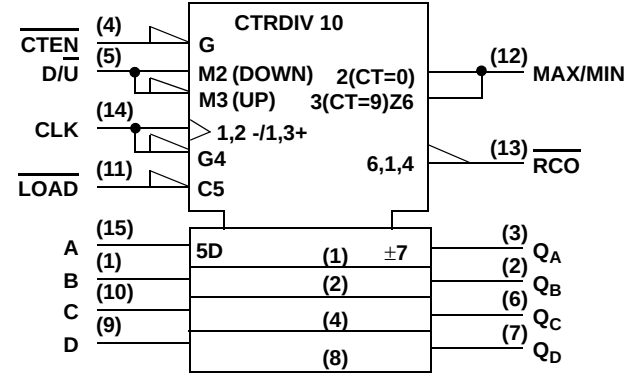
The ripple clock output ($\overline{\text{RCO}}$) produces a low-level output pulse under those same conditions but only while the clock input is low. The counters easily cascade by feeding the $\overline{\text{RCO}}$ to the enable input of the succeeding counter if parallel clocking is used, or to the clock input if parallel enabling is used. Use the MAX/MIN count output to accomplish look-ahead for high-speed operation.

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

FUNCTION TABLE

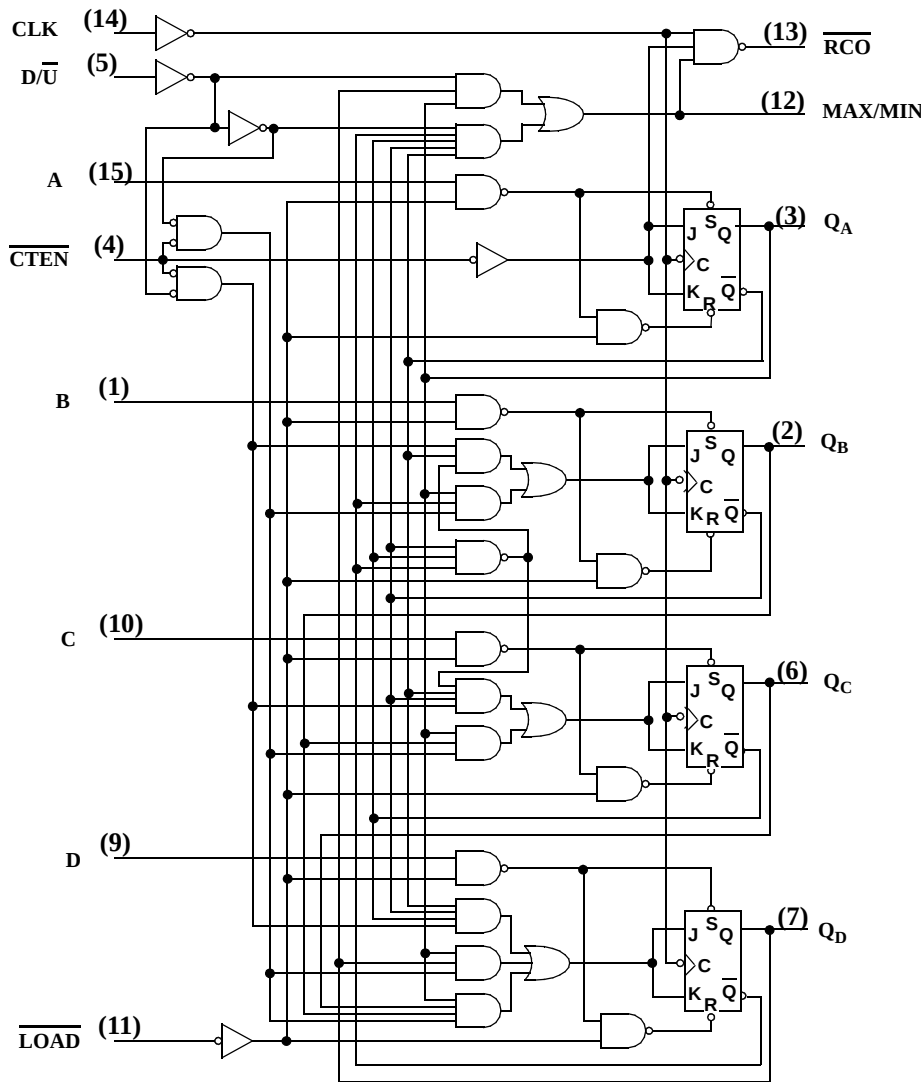
Function	$\overline{\text{LOAD}}$	$\overline{\text{CTEN}}$	$\text{D}/\overline{\text{U}}$	CLK
Count up	H	L	L	$\uparrow$
Count down	H	L	H	$\uparrow$
Asynchronous Reset	L	X	X	X
No change	H	H	X	X

LOGIC SYMBOL



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

LOGIC DIAGRAM



OPERATIONAL ENVIRONMENT¹

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	4.5 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 ⁷

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

SYMBOL	PARAMETER	CONDITION	MIN	MAX	UNIT
V_{IL}	Low-level input voltage ¹ ACTS ACS			0.8 .3 V_{DD}	V
V_{IH}	High-level input voltage ¹ 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	μA
V_{OL}	Low-level output voltage ³ ACTS ACS	$I_{OL} = 8.0mA$ $I_{OL} = 100\mu A$		0.40 0.25	V
V_{OH}	High-level output voltage ³ 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 ^{2,4} ACTS/ACS	$V_O = V_{DD}$ and V_{SS}	-200	200	mA
I_{OL}	Output current ¹⁰ (Sink)	$V_{IN} = V_{DD}$ or V_{SS} $V_{OL} = 0.4V$	8		mA
I_{OH}	Output current ¹⁰ (Source)	$V_{IN} = V_{DD}$ or V_{SS} $V_{OH} = V_{DD} - 0.4V$	-8		mA
P_{total}	Power dissipation ^{2, 8, 9}	$C_L = 50pF$		2.3	mW/ MHz
I_{DDQ}	Quiescent Supply Current	$V_{DD} = 5.5V$		10	μA
ΔI_{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 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 $\leq 5.0E5$ amps/cm², 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 specifications valid for radiation dose $\leq 1E6$ 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 ²

($V_{DD} = 5.0V \pm 10\%$; $V_{SS} = 0V$ ¹, $-55^{\circ}C < T_C < +125^{\circ}C$); Unless otherwise noted, T_c is per the temperature range ordered.

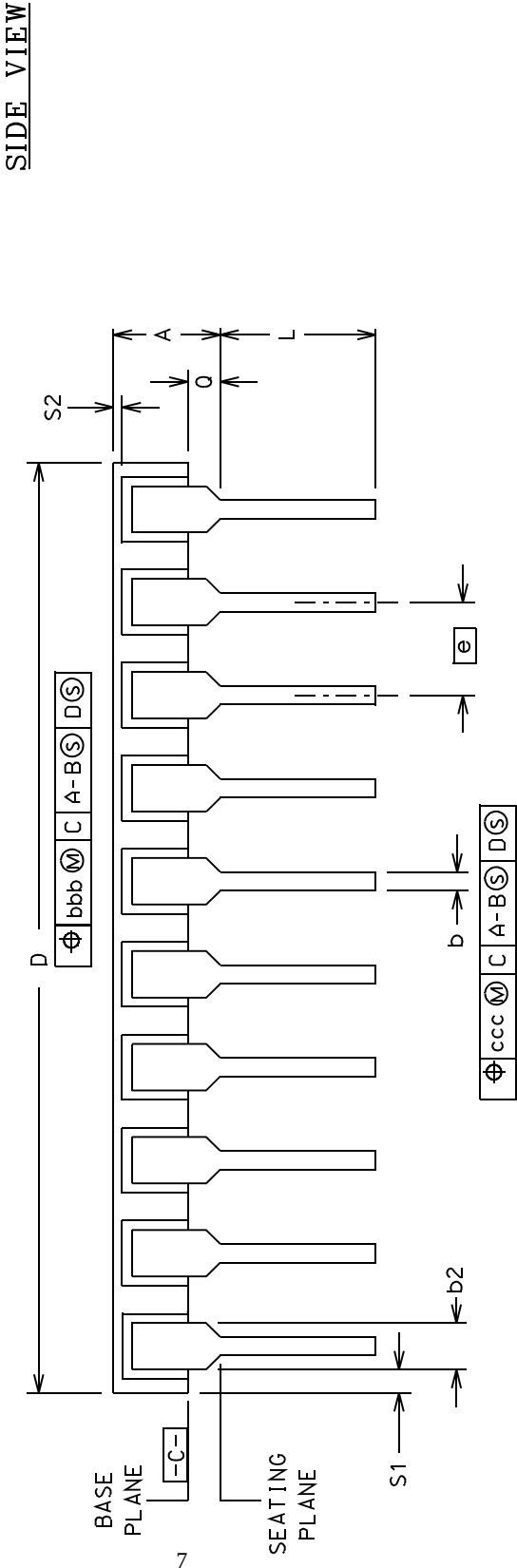
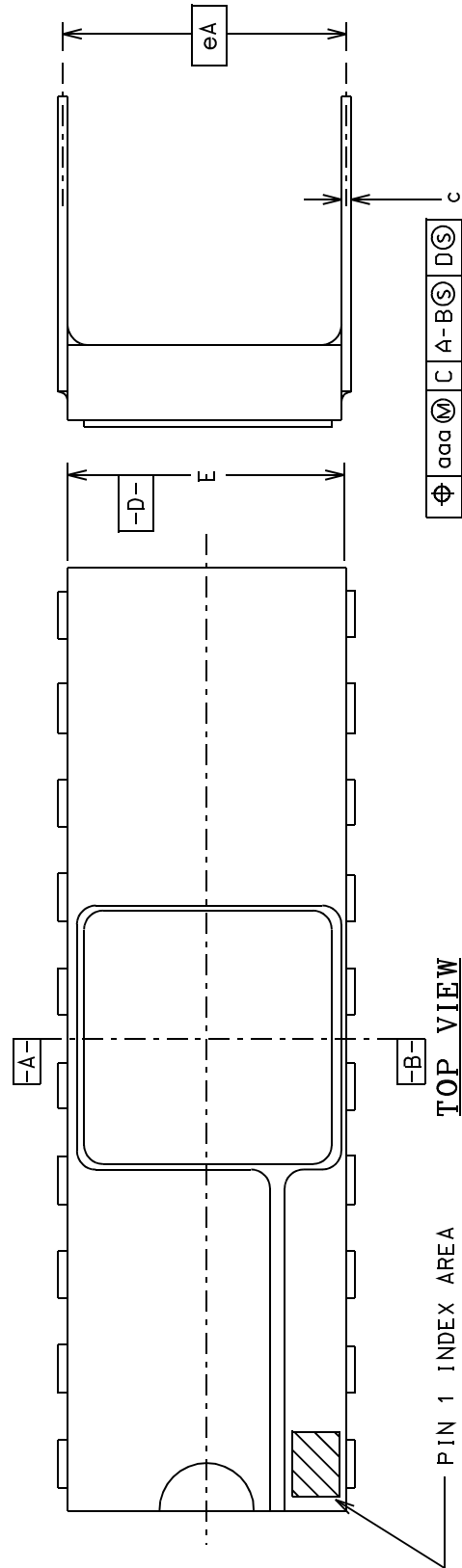
SYMBOL	PARAMETER	MINIMUM	MAXIMUM	UNIT
t_{PLH}	$\overline{LOAD}$ to Q_n	2	19	ns
t_{PHL}	$\overline{LOAD}$ to Q_n	2	22	ns
t_{PLH}	Data In to Q_n	2	19	ns
t_{PHL}	Data In to Q_n	2	21	ns
t_{PLH}	CLK to Q_n	2	18	ns
t_{PHL}	CLK to Q_n	2	20	ns
t_{PLH}	CLK to $\overline{RCO}$	2	16	ns
t_{PHL}	CLK to $\overline{RCO}$	2	16	ns
t_{PLH}	CLK to MAX/MIN	2	18	ns
t_{PHL}	CLK to MAX/MIN	2	23	ns
t_{PLH}	$D/\overline{U}$ to $\overline{RCO}$	2	16	ns
t_{PHL}	$D/\overline{U}$ to $\overline{RCO}$	2	18	ns
t_{PLH}	$D/\overline{U}$ to MAX/MIN	1	14	ns
t_{PHL}	$D/\overline{U}$ to MAX/MIN	2	18	ns
t_{PLH}	$\overline{CTEN}$ to $\overline{RCO}$	2	12	ns
t_{PHL}	$\overline{CTEN}$ to $\overline{RCO}$	2	16	ns
f_{MAX}	Maximum clock frequency		71	MHz
t_{SU1}	$\overline{CTEN}$, $D/\overline{U}$ Setup time before CLK $\uparrow$	13		ns
t_{SU2}	$\overline{LOAD}$ Setup time before CLK $\uparrow$	2		ns
t_{SU3}	A, B, C, D setup time before $\overline{LOAD}$ $\uparrow$	7		ns
t_{H1}	$\overline{CTEN}$ and $D/\overline{U}$ hold time after CLK $\uparrow$	2		ns
t_{H2} ³	A, B, C, D hold time after $\overline{LOAD}$ $\uparrow$	2		ns
t_W	Minimum pulse width CLK high CLK low $\overline{LOAD}$ low	7		ns

Notes:

1. Maximum allowable relative shift equals 50mV.
2. All specifications valid for radiation dose $\leq 1E6$ rads(Si).
3. Based on characterization, hold time (t_{H2}) of 0ns can be assumed if data setup time (t_{SU3}) is ≥ 10 ns. This is guaranteed, but not tested.

PACKAGING

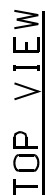
Side-Brazed Packages



FRONT VIEW

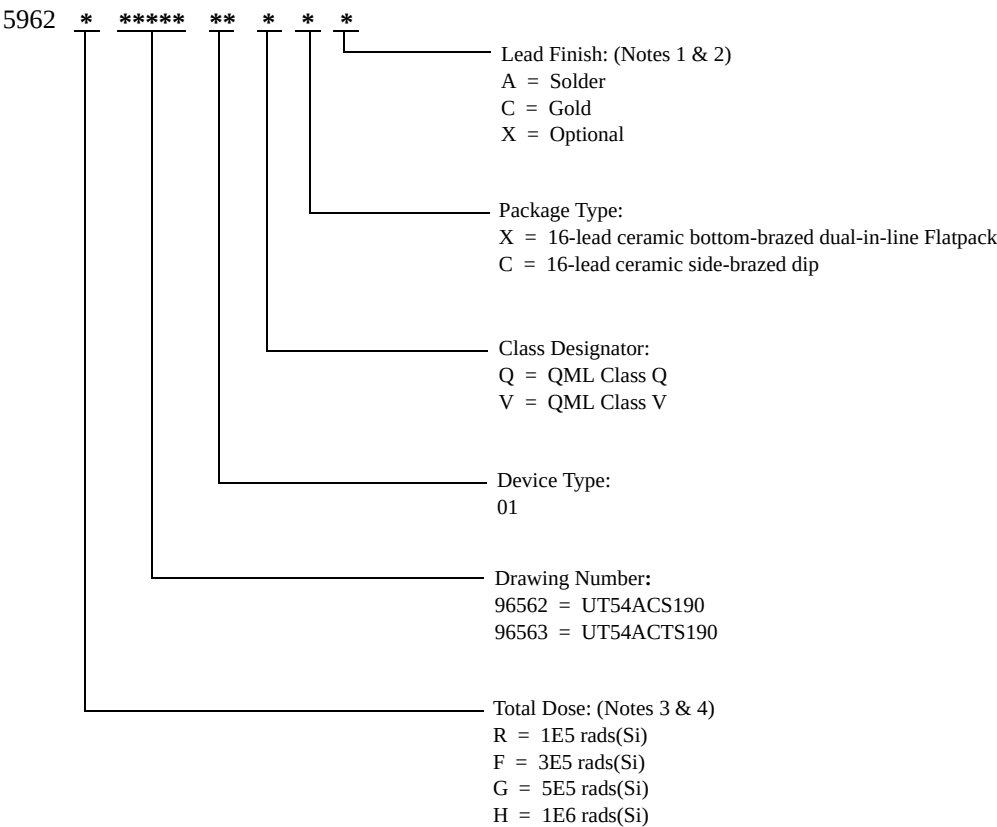
PKG CONFIG	LEAD COUNT	MIL-STD- 1835 DWG CONF C	DIMENSION SYMBOLS														
			A	b	b2	c	D	E	e	eA	L	Q	S1	S2	aaa	bbb	ccc
-01	14	D-1	0.200 -----	0.026 0.014	0.065 0.045	0.018 0.008	0.785 -----	0.310 0.220	0.100 BSC	0.300 BSC	0.200 0.125	0.060 0.015	----- 0.005	----- 0.005	0.015 -----	0.030 -----	0.010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

PIN #1 ID MARK



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	0.022	0.009	0.390	0.260	0.290	-----	-----	0.050	0.015	0.370	0.045	-----
			0.045	0.015	0.004	-----	0.235	-----	0.130	0.030	BSC	0.008	0.270	0.026	0.005
-04	16	F-5A	0.115	0.022	0.009	0.440	0.285	0.315	-----	-----	0.050	0.015	0.370	0.045	-----
			0.045	0.015	0.004	-----	0.245	-----	0.130	0.030	BSC	0.008	0.250	0.026	0.005
-05	20	F-9A	0.115	0.022	0.009	0.540	0.300	0.330	-----	-----	0.050	0.015	0.370	0.045	-----
			0.045	0.015	0.004	-----	0.245	-----	0.130	0.030	BSC	0.008	0.250	0.026	0.000

UT54ACS190/UT54ACTS190: 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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Tel: 949-362-2260
Fax: 949-362-2266

CENTRAL

Tel: 719-594-8017
Fax: 719-594-8468

www.aeroflex.com info-ams@aeroflex.com

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