

## QUAD MULTIFUNCTION VOLTAGE REGULATOR FOR CAR RADIO

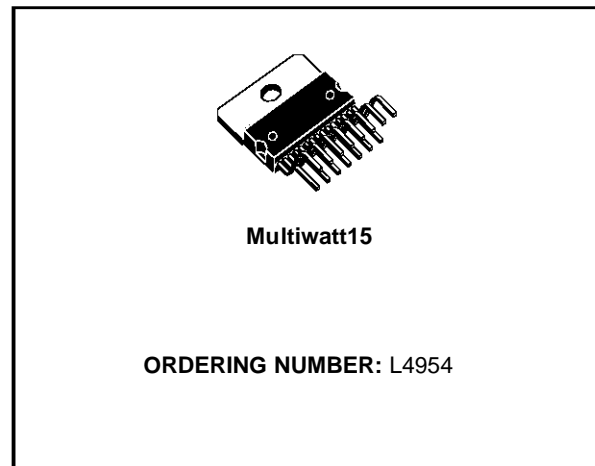
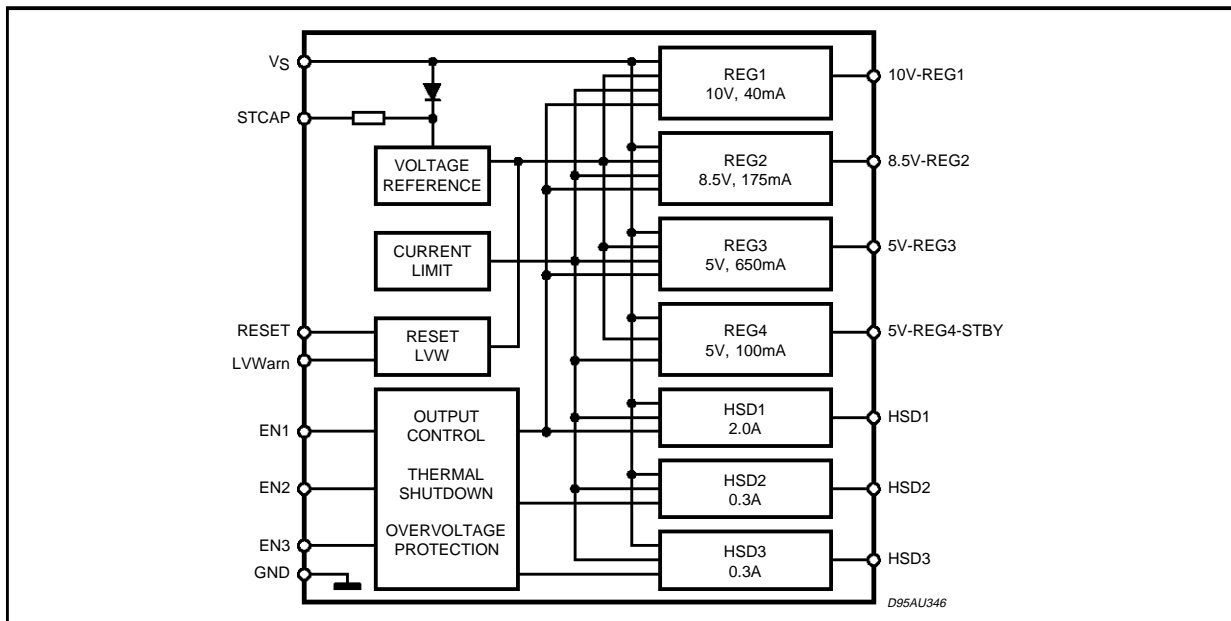
PRODUCT PREVIEW

- 4 REGULATORS  
10V (40mA); 8.5V (175mA); 5V (650mA);  
5V (100mA) STANDBY
- 10V AND 5V STAND BY REGULATORS ARE  
LOW DROPOUT OUTPUTS
- 3 HIGH SIDE DRIVERS:  
2A (HSD1), 0.3A (HSD2 & HSD3)
- NO EXTERNAL CHARGE PUMP CAPACI-  
TORS ARE REQUIRED
- STAND BY MODE CONTROLLED BY 3 IN-  
PUT PINS:  
EN1 FOR REG1, REG2, REG3 AND HSD1,  
EN2 FOR HSD2, AND EN3 FOR HSD3
- INDIVIDUAL THERMAL SHUTDOWN
- LOGIC OUTPUTS FOR SUPPLY UNDER-  
VOLTAGE: (LVWARN, RESET)
- INDEPENDENT CURRENT LIMITING
- OVERVOLTAGE SHUTDOWN
- SHORT CIRCUIT PROTECTION
- LOAD DUMP PROTECTION AND OVERVOL-  
TAGE SHUTDOWN

### DESCRIPTION

L4954 is a quad output voltage regulator and a

### BLOCK DIAGRAM



three output high side driver.

The IC includes monitoring circuitry to warn the microprocessor of a low voltage condition: the LVWarn, output, sensing the slow dropping of STCAP pins voltage, gives the microprocessor time to store data.

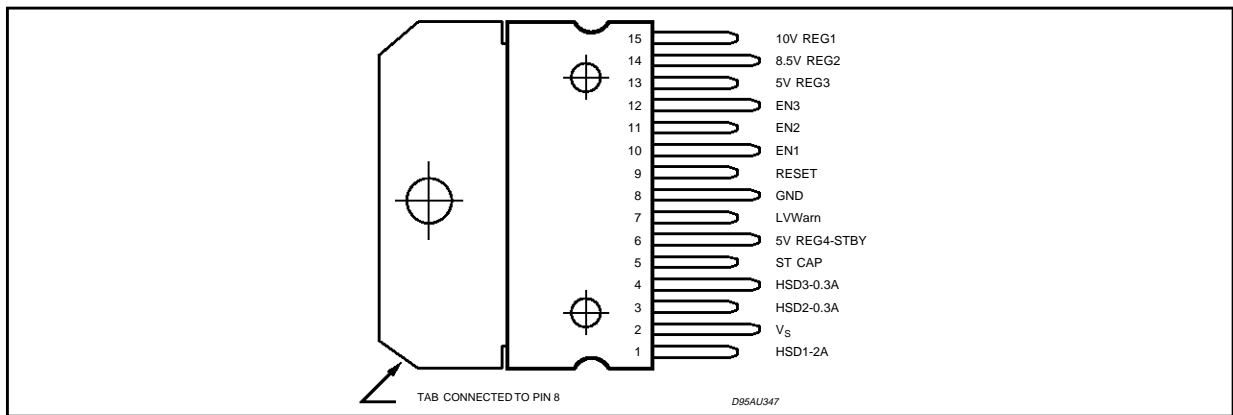
A RESET output is generated at REG4's decay.

External protection must be provided for reverse battery protection.

**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
$V_S$	DC Operating Supply Voltage	-0.6 to 26.5	V
$V_S$	Transient Supply Overvoltages, rise time = 10ms delay time = 115ms	34	V
$V_{S,ovs}$	Overvoltage Shutdown	27	V
$V_{in}$	Input Voltages (EN1, EN2, EN3)	-0.6 to 6.0	V
$V_{out}$	Output Voltages (LVWarn, RESET)	-0.6 to 6.0	V
$T_{op}$	Operating Temperature Range	-40 to 85	°C
$T_{stg}$	Storage Temperature Range	-40 to 150	°C

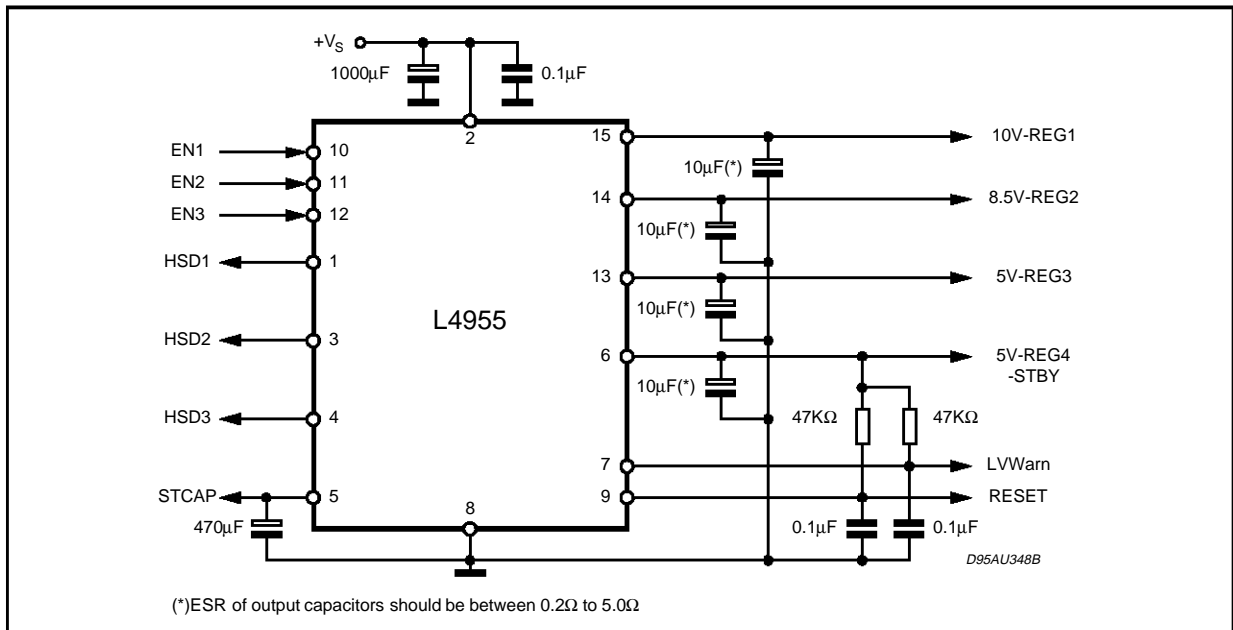
**PIN CONNECTION**



**THERMAL DATA**

Symbol	Parameter	Value	Unit
$R_{th j-case}$	Thermal Resistance Junction-case	2	°C/W

**APPLICATION CIRCUIT**



**ELECTRICAL CHARACTERISTICS** (Refer to the application circuit,  $V_S = 14.4V$ ;  $T_{amb} = 25^\circ C$ ;  $I_{OUT10} = 5mA$ ;  $I_{OUT8.5} = 5mA$ ;  $I_{OUT5} = 5mA$ ;  $I_{OUT5\ ST-BY} = 0.5mA$ ;  $R_{HSD1} = 16\Omega$ ,  $R_{HSD2,3} = 107\Omega$ , unless otherwise specified.)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
$V_S$	Operating Supply Voltage		11		16	V
$I_q$	Maximum Quiescent Current	$I_{OUT10} = 40mA$ ; $I_{OUT8.5} = 175mA$ ; $I_{OUT5} = 650mA$ ; $I_{OUT5\ ST-BY} = 100mA$ ; $R_{HSD1} = 8\Omega$ ; $R_{HSD2,3} = 53\Omega$		10		mA
$I_{q,ST-BY}$	Standby Quiescent Current	EN1, EN2, EN3 = 0 $I_{OUT5, ST-BY} = 50mA$ ;		420		$\mu A$
		EN1, EN2, EN3 = 0 $I_{OUT5, ST-BY} = 2mA$ ;		300		$\mu A$
$V_{ENL}$	EN1, EN2, EN3 Input Low Voltage		0		0.8	V
$V_{ENH}$	EN1, EN2, EN3 Input High Voltage (Outputs Active)		2		5	V
<b>10V / 40mA REG 1 OUTPUT</b>						
$V_{OUT10}$	Output Voltage	$I_{OUT10} = 40mA$		10		V
$\Delta V_{line}$	Line Regulation	$V_S = 11$ to 26V		2		mV
$\Delta V_{load}$	Load Regulation	$I_{out10} = 5$ to 40mA		2		mV
$V_{DROPOUT}$	Dropout Voltage	$V_S = V_{OUT10} + 0.1V$ $I_{out10} = 5mA$		100	200	mV
		$V_S = V_{OUT10} + 0.5V$ $I_{out10} = 40mA$		500	600	mV
$I_{q1}$	Reg 1 Quiescent Current	$I_{OUT10} = 5mA$		7		mA
		$I_{OUT10} = 40mA$		7		mA
$I_{lim1}$	Current Limit			100		mA
$SVR_1$	Reg 1 Supply Voltage Rejection	$f = 0.12$ to 10KHz; $I_{OUT10} = 25mA$ ; $V_{RIP} = 1V_{pp}$		55		dB
<b>8.5V / 175mA REG 2 OUTPUT</b>						
$V_{OUT8.5}$	Output Voltage	$I_{OUT8.5} = 175mA$		8.5		V
$\Delta V_{line}$	Line Regulation	$V_S = 11$ to 26V		2		mV
$\Delta V_{load}$	Load Regulation	$I_{out8.5} = 5$ to 175mA		10		mV
$V_{DROPOUT}$	Dropout Voltage	$V_S = V_{OUT8.5} + 0.3V$ $I_{out8.5} = 5mA$		300	400	mV
		$V_S = V_{OUT8.5} + 1V$ $I_{out8.5} = 175mA$		1	1.1	V
$I_{q2}$	Reg 2 Quiescent Current	$I_{OUT8.5} = 5mA$		7		mA
		$I_{OUT8.5} = 175mA$		7		mA
$I_{lim2}$	Current Limit			300		mA
$SVR_2$	Reg 1 Supply Voltage Rejection	$f = 0.12$ to 10KHz; $I_{OUT8.5} = 100mA$ ; $V_{RIP} = 1V_{pp}$		55		dB

## ELECTRICAL CHARACTERISTICS (Continued)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
<b>5V / 650mA REG 3 OUTPUT</b>						
$V_{OUT5}$	Output Voltage	$I_{OUT5} = 650mA$		5		V
$\Delta V_{line}$	Line Regulation	$V_S = 7 \text{ to } 26V$		2		mV
$\Delta V_{load}$	Load Regulation	$I_{out5} = 5 \text{ to } 650mA$		9		mV
$V_{DROPOUT}$	Dropout Voltage	$V_S = V_{OUT5} + 0.3V$ $I_{out5} = 5mA$		300	400	mV
		$V_S = V_{OUT5} + 1V$ $I_{out5} = 650mA$		1	1.1	V
$I_{q3}$	Reg 3 Quiescent Current	$I_{OUT5} = 5mA$		7		mA
		$I_{OUT5} = 650mA$		7		mA
$I_{lim3}$	Current Limit			1.25		A
$SVR_3$	Reg 3 Supply Voltage Rejection	$f = 0.12 \text{ to } 10KHz$ ; $I_{OUT5} = 325mA$ ; $V_{RIP} = 1V_{pp}$		55		dB
<b>5V / 100mA STAND-BY REG 4 OUTPUT</b>						
$V_{OUT5STBY}$	Output Voltage	$I_{OUT5STBY} = 100mA$		5		V
$\Delta V_{line}$	Line Regulation	$V_S = 7 \text{ to } 26V$		0.8		mV
$\Delta V_{load}$	Load Regulation	$I_{out} = 0.5 \text{ to } 100mA$		3.5		mV
$V_{DROPOUT}$	Dropout Voltage	$V_S = V_{REG5STBY} + 0.1V$ $I_{out5STBY} = 5mA$		100	200	mV
		$V_S = V_{REG5STBY} + 0.5V$ $I_{out5STBY} = 100mA$		500	600	mV
$I_{q4}$	Reg 4 Quiescent Current	$I_{OUT5STBY} = 2mA$		0.25		mA
		$I_{OUT5STBY} = 100mA$		0.35		mA
$I_{lim4}$	Current Limit			190		mA
$SVR_4$	Reg 4 Supply Voltage Rejection	$f = 0.12 \text{ to } 10KHz$ $I_{out5STBY} = 50mA$ ; $V_{RIP} = 1V_{pp}$		55		dB
<b>2A HSD1</b>						
$V_{sat,peak}$	Maximum Output Current Saturation Voltage	$R_{HSD1} = 8\Omega$		600		mV
$I_q$	Quiescent Current			9		mA
$I_{lim}$	Current Limit	$R_{HSD1} = 0.5\Omega$		3.5		A
$I_{leak1}$	Output Leakage Current	All driver outputs are off		20		$\mu A$
<b>0.3A HSD2 &amp; HSD3</b>						
$V_{sat}$	Maximum Output Current Saturation Voltage	$R_{HSD2,3} = 53\Omega$		150		mV
$I_q$	Quiescent Current			1.5		mA
$I_{lim}$	Current Limit	$R_{HSD2,3} = 0.5\Omega$		500		mA
$I_{leak2,3}$	Output Leakage Current	All driver outputs are off		10		$\mu A$

## ELECTRICAL CHARACTERISTICS (Continued)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
<b>LVWARN OUTPUT</b>						
$TH_{LVW}$	LVW Threshold on STCAP			7.5		V
$V_{LVW}$	LVW Output Voltage	STCAP < 7.5V; $V_{IL} = "0"$	0		0.4	V
		STCAP > 7.5V $V_{IH} = "1"$	2.75		5	V
$t_{rise}$	LVW Output Rise Time	$C_{LVW} = 0.1\mu F$		3.9		ms
$t_{fall}$	LVW Output Fall Time	$C_{LVW} = 0.1\mu F$		12.6		$\mu s$
<b>RESET OUTPUT</b>						
$TH_{RES}$	Reset Threshold on Reg 4			4.5		V
$V_{RES}$	Reset Output Voltage	Set $V_S$ so that $V_{OUT5STBY} < 4.5V$ ; $V_{IL} = "0"$	0		0.4	V
		Set $V_S$ so that $V_{OUT5STBY}$ is not less than normal REG4 output voltage; $V_{IH} = "1"$	2.75		5	V
$t_{rise}$	Reset Output Rise Time	$C_{RESET} = 0.1\mu F$		4.5		ms
$t_{fall}$	Reset Output Fall Time	$C_{RESET} = 0.1\mu F$		37		$\mu s$

## FUNCTIONAL DESCRIPTION

The L4954 includes a monitoring circuit to warn the microprocessor if a low voltage or no voltage condition is occurring.

When the voltage on the STCAP pin drops below 7.5V (typ), the LVW output will go low. This tells the microprocessor to stop executing code and save vital information. The reset output will go low when REG4 (5V-STBY) drops below ( $V_{REG4} - 250mV$ ) or 4.75V is minimum value. The RESET output doesn't go above 0.4V until REG4 has gone back above 4.75V (min).

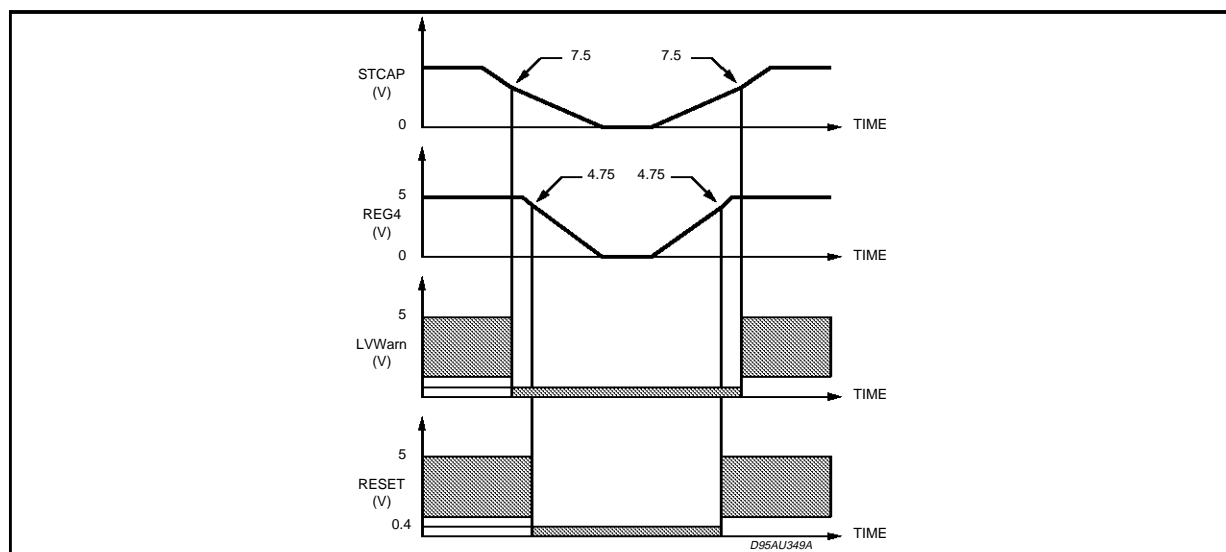
Any spike will tell the microprocessor to start operating. Once the STCAP line passes 7.5V (typ), the LVWarn output will also return to high state. The STCAP pin acts like a delay circuit. Due to the large capacitor (470 $\mu F$ ), the STCAP pin al-

lows the battery voltage to decay slowly giving the microprocessor time to store data.

Also, during short low voltage or negative voltage conditions, the STCAP pin protects the 5V STBY output from dropping below the RESET and LVW trip points. The four outputs are expected to follow the battery voltage down to 11V for REG1, 9V for REG2, 6V for REG3 and REG4.

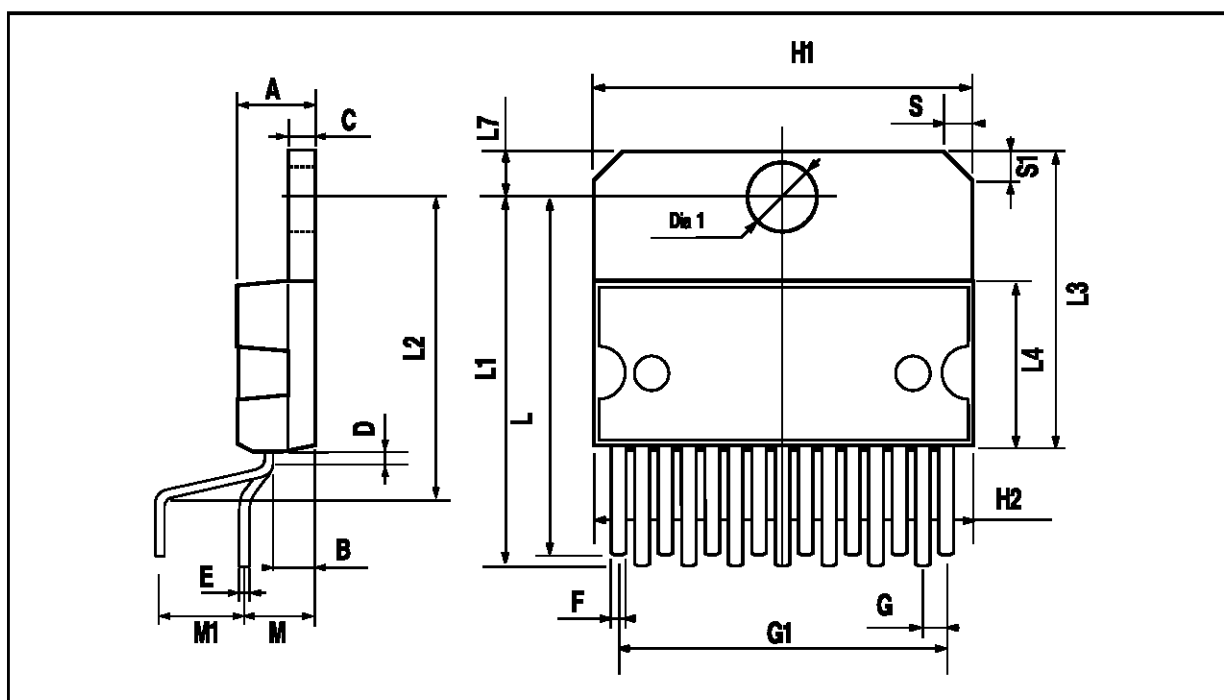
The L4954 has a STBY mode to keep the microprocessor and memories alive during an ignition off conditions. The EN1 input pin is controlled by the microprocessor. A high on the EN1 input turns on REG1, REG2, REG3, and HSD1. A Low on EN1 places the part in stand-by mode with REG4 on. The High side driver outputs HSD2 and HSD3 are controlled by EN2 and EN3 respectively: a Low on the control input turns the corresponding high side driver off.

## TIMING DIAGRAM



## MULTIWATT15 PACKAGE AND MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			5			0.197
B			2.65			0.104
C			1.6			0.063
D		1			0.039	
E	0.49		0.55	0.019		0.022
F	0.66		0.75	0.026		0.030
G	1.02	1.27	1.52	0.040	0.050	0.060
G1	17.53	17.78	18.03	0.690	0.700	0.710
H1	19.6			0.772		
H2			20.2			0.795
L	21.9	22.2	22.5	0.862	0.874	0.886
L1	21.7	22.1	22.5	0.854	0.870	0.886
L2	17.65		18.1	0.695		0.713
L3	17.25	17.5	17.75	0.679	0.689	0.699
L4	10.3	10.7	10.9	0.406	0.421	0.429
L7	2.65		2.9	0.104		0.114
M	4.25	4.55	4.85	0.167	0.179	0.191
M1	4.63	5.08	5.53	0.182	0.200	0.218
S	1.9		2.6	0.075		0.102
S1	1.9		2.6	0.075		0.102
Dia1	3.65		3.85	0.144		0.152



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