TSM103/A

DUAL OPERATIONAL AMPLIFIER AND VOLTAGE REFERENCE

OPERATIONAL AMPLIFIER

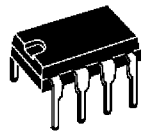
- LOW INPUT OFFSET VOLTAGE : 0.5mV typ.for TSM103A
- LOW SUPPLY CURRENT : 350µA/op. (@ V_{CC} = 5V)
- MEDIUM BANDWIDTH (unity gain) : 0.9MHz
- LARGE OUTPUT VOLTAGE SWING : 0V to (V_{CC} - 1.5V)
- INPUT COMMON MODE VOLTAGE RANGE INCLUDES GROUND
- WIDE POWER SUPPLY RANGE : 3 to 32V ±1.5 to œ16V

VOLTAGE REFERENCE

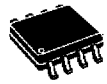
- FIXED OUTPUT VOLTAGE REFERENCE 2.5V
- 0.4% AND 1% VOLTAGE PRECISION
- SINK CURRENT CAPABILITY : 1 to 100mA
- TYPICAL OUTPUT IMPEDANCE : 0.2Ω

DESCRIPTION

The TSM103 is a monolithic IC that includes one independent op-amp and another op-amp for which the non inverting input is wired to a 2.5V fixed Voltage Reference. This device is offering space and cost saving in many applications like power supply management or data acquisition systems.



N
DIP8
(Plastic Package)

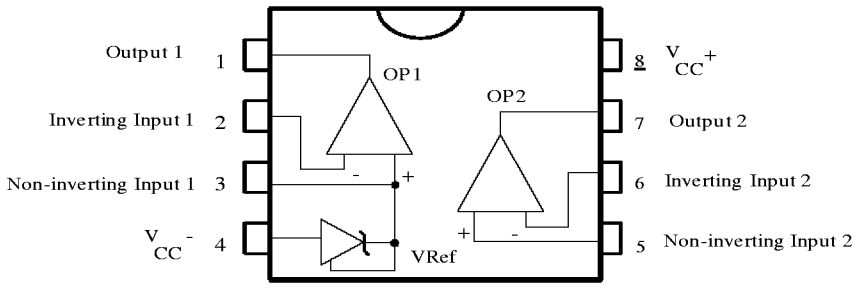


D
SO8
(Plastic Micropackage)

ORDER CODES

Part number	Temperature Range	Package	
		N	D
TSM103I/AI	-40°C, +105°C	•	•

PIN CONNECTIONS



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	36	V
V_{id}	Differential Input Voltage	36	V
V_i	Input Voltage	-0.3 to +36	V
T_{oper}	Operating Free-air Temperature Range	-55 to +125	°C
T_j	Maximum Junction Temperature	150	°C
R_{thja}	Thermal Resistance Juction to Ambient (SO package)	175	°C/W

ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Min	Typ	Max	Unit
I_{CC}	Total Supply Current, excluding Current in the Voltage Reference				mA
	V_{CC}^+ = 5V, no load		0.7	1.2	
	$T_{min.} < T_{amb} < T_{max.}$				
	V_{CC}^+ = 30V, no load			2	
	$T_{min.} < T_{amb} < T_{max}$				

OPERATOR 2 (independent op-amp)
$V_{CC}^+ = +5V$, V_{CC} = Ground, $V_o = 1.4V$, $T_{amb} = 25°C$ (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage TSM103, $T_{amb} = 25°C$ $T_{min.} \le T_{amb} \le T_{max.}$ TSM103A, $T_{amb} = 25°C$ $T_{min.} \le T_{amb} \le T_{max.}$		1 0.5	4 5 2 3	mV
DV_{io}	Input Offset Voltage Drift		7		µV/°C
I_{io}	Input Offset Current $T_{min.} \le T_{amb} \le T_{max.}$		2	30 50	nA
I_{ib}	Input Bias Current $T_{min.} \le T_{amb} \le T_{max.}$		20	150 200	nA
A_{vd}	Large Signal Voltage Gain V_{CC} = 15V, R_L= 2k, V_o = 1.4V to 11.4V $T_{min.} \le T_{amb} \le T_{max.}$	50 25	100		V/mV
SVR	Supply Voltage Rejection Ratio V_{CC}^+ = 5V to 30V	65	100		dB
V_{icm}	Input Common Mode Voltage Range V_{CC} = +30V - see note 1 $T_{min.} \le T_{amb} \le T_{max.}$	0 0		(VCC^+) -1.5 (V_{CC}^+) -2	V
CMR	Common Mode Rejection Ratio $T_{min.} \le T_{amb} \le T_{max.}$	70 60	85		dB
I_{source}	Output Current Source V_{CC} = +15V, V_o = 2V, V_{id} = +1V	20	40		mA
I_O	Short Circuit to Ground V_{CC} = +15V		40	60	mA
I_{sink}	Output Current Sink V_{id} = -1V, V_{CC} = +15V, V_o = 2V	10	20		mA
V_{OH}	High Level Output Voltage V_{CC}^+ = 30V $T_{amb} = 25°C$, R_L = 10k $T_{min.} \le T_{amb} \le T_{max.}$	27 27	28		V
V_{OL}	Low Level Output Voltage R_L = 10k $T_{min.} \le T_{amb} \le T_{max.}$		5	20 20	mV
SR	Slew Rate at Unity Gain V_i = 0.5 to 3V, V_{CC} = 15V R_L = 2k, C_L = 100pF, unity gain	0.2	0.4		V/µs
GBP	Gain Bandwidth Product V_{CC} = 30V, R_L = 2k, C_L = 100pF f = 100kHz, V_{in} = 10mV	0.5	0.9		MHz
THD	Total Harmonic Distortion f = 1kHz A_V = 20dB, R_L = 2k, V_{CC} = 30V C_L = 100pF, V_O = $2V_{pp}$		0.02		%

Note 1 : The input common-mode voltage of either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is V_{CC}^+ -1.5V
But either of both inputs can go to +36V without damage.

OPERATOR 1 (op-amp with non-inverting input connected to the internal Vref)
$V_{CC}^+ = +5V$, $V_{CC}^- =$ Ground, $T_{amb} = 25°C$ (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage V_{icm} = 0V TSM103, T_{amb} = 25°C $T_{min.} \le T_{amb} \le T_{max.}$ TSM103A, T_{amb} = 25°C $T_{min.} \le T_{amb} \le T_{max.}$		 1 0.5	 4 5 2 3	mV
DV_{io}	Input Offset Voltage Drift		7		µV/°C
I_{ib}	Input Bias Current negative input		 20		nA
A_{vd}	Large Signal Voltage Gain V_{icm} = 0V V_{CC} = 15V, R_L = 2k		 100		V/mV
SVR	Supply Voltage Rejection Ratio V_{icm} = 0V V_{CC}^+ = 5V to 30V	 65	 100		dB
I_{source}	Output Current Source V_o = 2V V_{CC} = +15V, V_{id} = +1V	 20	 40		mA
I_O	Short Circuit to Ground V_{CC} = +15V		 40	 60	mA
I_{sink}	Output Current Sink V_{id} = -1V, V_{CC} = +15V, V_o = 2V	 10	 20		mA
V_{OH}	High Level Output Voltage V_{CC}^+ = 30V T_{amb} = 25°C, R_L = 10k $T_{min.} \le T_{amb} \le T_{max.}$	 27 27	 28		V
V_{OL}	Low Level Output Voltage R_L = 10k $T_{min.} \le T_{amb} \le T_{max.}$		 5	 20 20	mV
SR	Slew Rate at Unity Gain V_i = 0.5 to 2V, V_{CC} = 15V R_L = 2k, C_L = 100pF, unity gain	0.2	0.4		V/µs
GBP	Gain Bandwidth Product V_{CC} = 30V, R_L = 2k, C_L = 100pF f = 100kHz, V_{in} = 10mV	0.5	0.9		MHz
THD	Total Harmonic Distortion f = 1kHz A_V = 20dB, R_L = 2k, V_{CC} = 30V C_L = 100pF, V_O = $2V_{pp}$		 0.02		%

VOLTAGE REFERENCE

Symbol	Parameter	Value	Unit
I_K	Cathode Current	1 to 100	mA

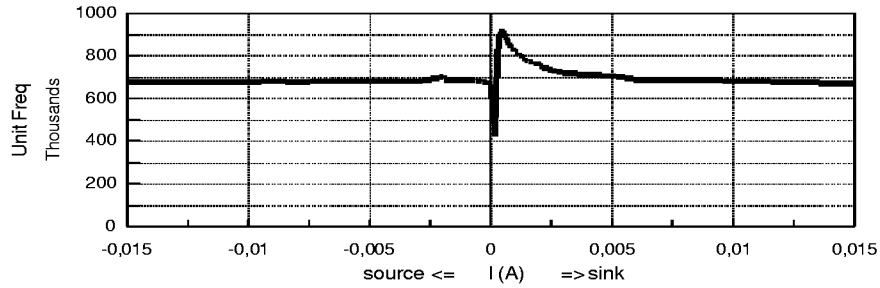
Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{ref}	Reference Input Voltage TSM103, T_{amb} = 25°C $T_{min.} \le T_{amb} \le T_{max.}$ TSM103A, T_{amb} = 25°C $T_{min.} \le T_{amb} \le T_{max.}$	 2.475 2.45 2.49 2.48	 2.5 2.5 	 2.525 2.55 2.51 2.52	V
ΔV_{ref}	Reference Input Voltage Deviation Over Temperature Range $V_{KA} = V_{ref}$, I_K = 10mA $T_{min.} \le T_{amb} \le T_{max.}$		 7	 30	mV
I_{min}	Minimum Cathode Current for Regulation $V_{KA} = V_{ref}$		 0.5	 1	mA
$\|Z_{KA}\|$	Dynamic Impedance - (note 1) $V_{KA} = V_{ref}$, ΔI_K = 1 to 100mA, f < 1kHz		0.2	0.5	Ω

Note 1 : the dynamic impedance is defined as $|Z_{KA}| = \Delta V_{KA}/\Delta I_K$

OPERATIONAL AMPLIFIERS

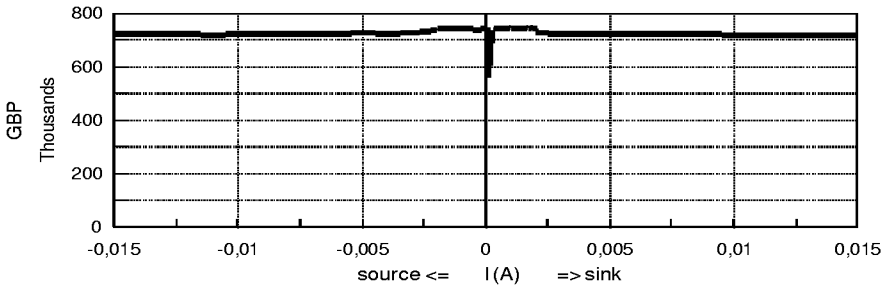
Unit Frequency = F(I)

Vcc=+/-15V, RL=2k, CL=100pF



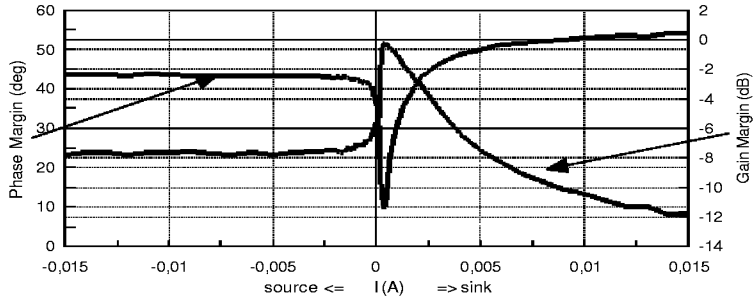
GBP = F(I)

Vcc=+/-15V, RL=2k, CL=100pF

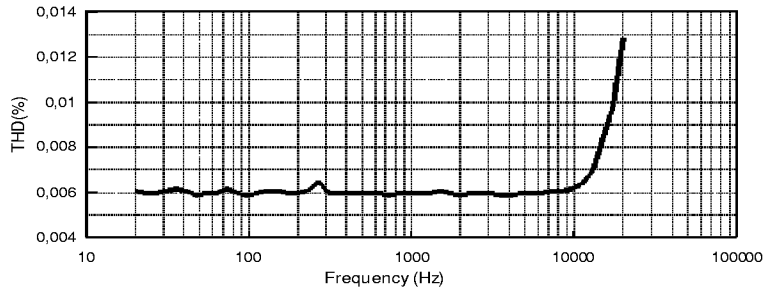


Phase and Gain Margin = F(I)

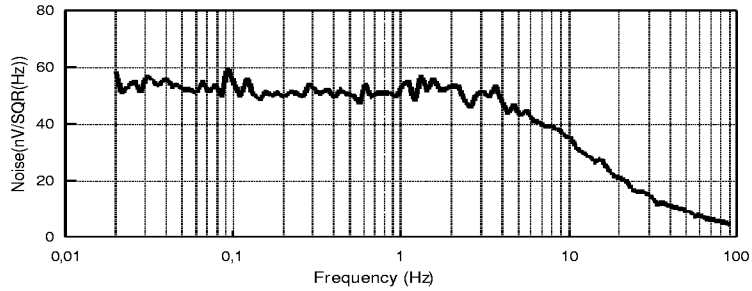
Vcc=+/-15V, RL=2k, CL=100pF



Total Harmonic Distorsion THD = F(freq)

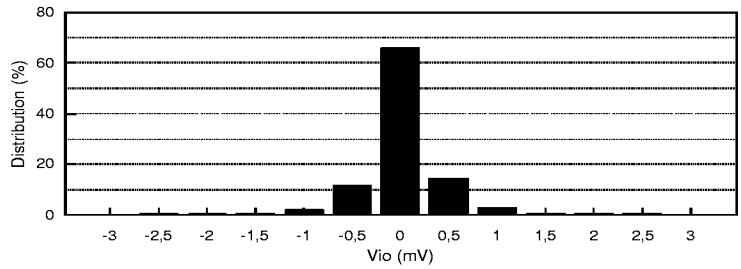


Noise = F(frequency)



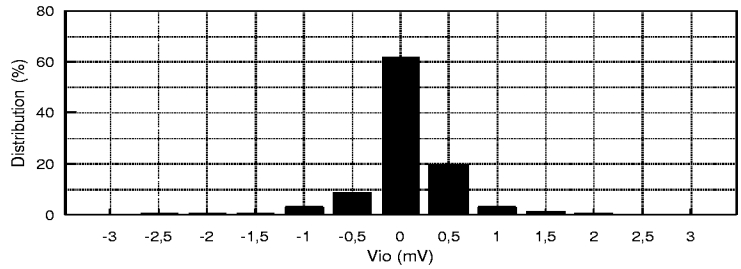
Vio Distribution - Operator 1

Vcc+=5V, Vcc-=0V

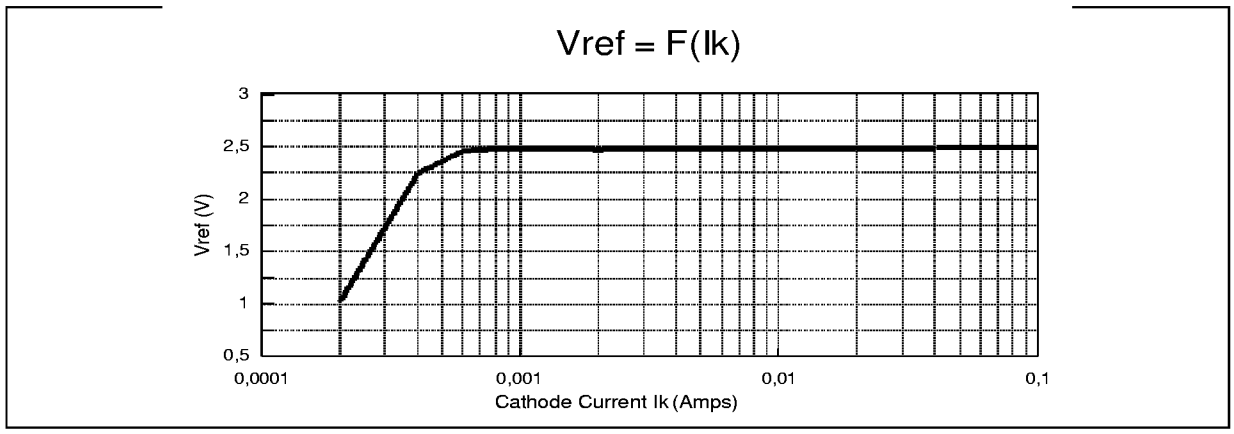


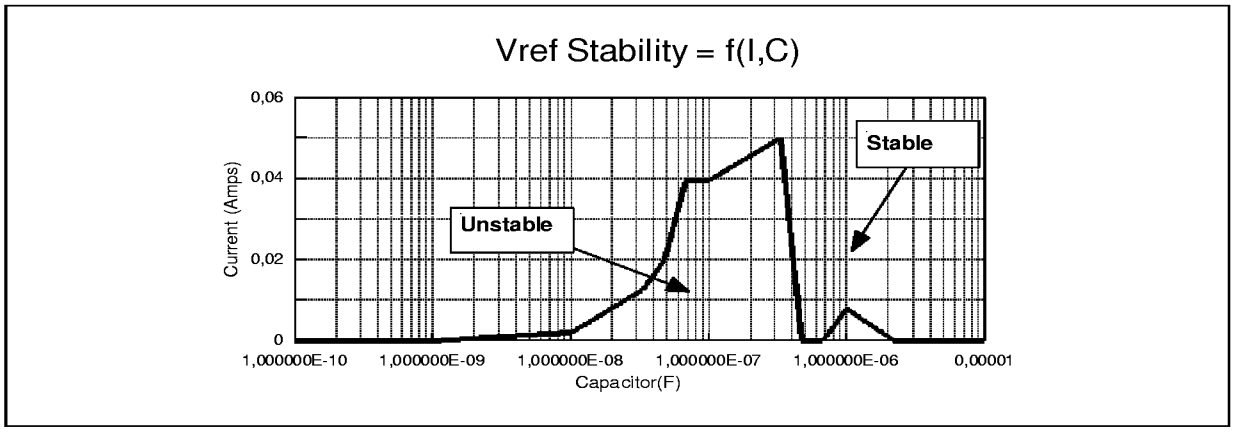
Vio Distribution - Operator 2

Vcc+=5V, Vcc-=0V

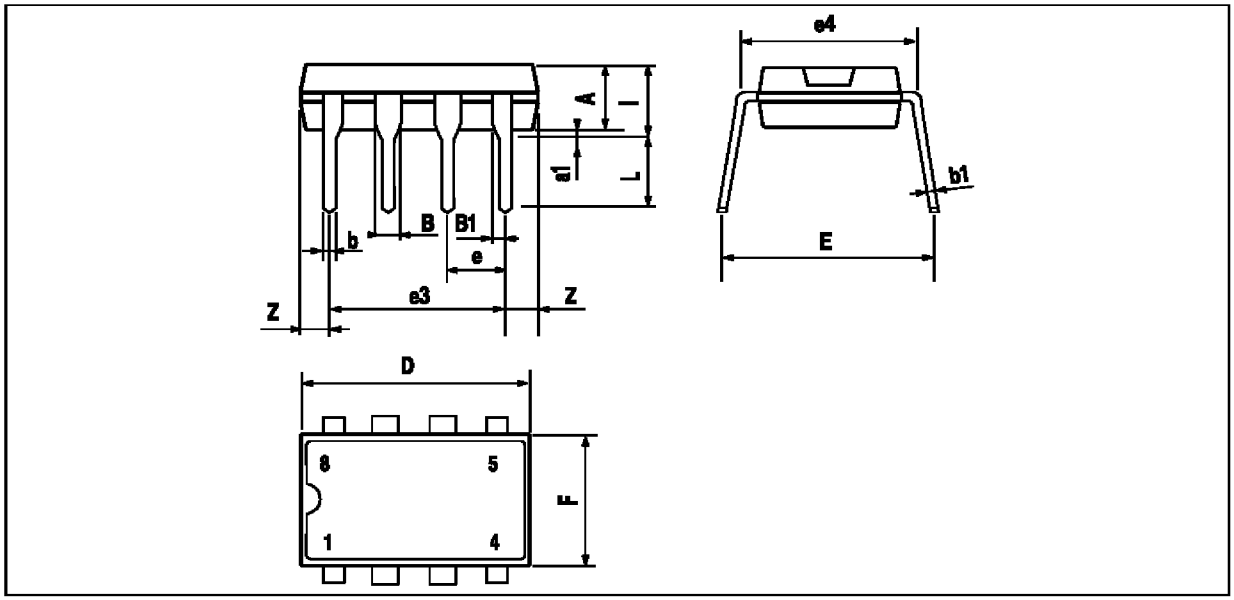


VOLTAGE REFERENCE





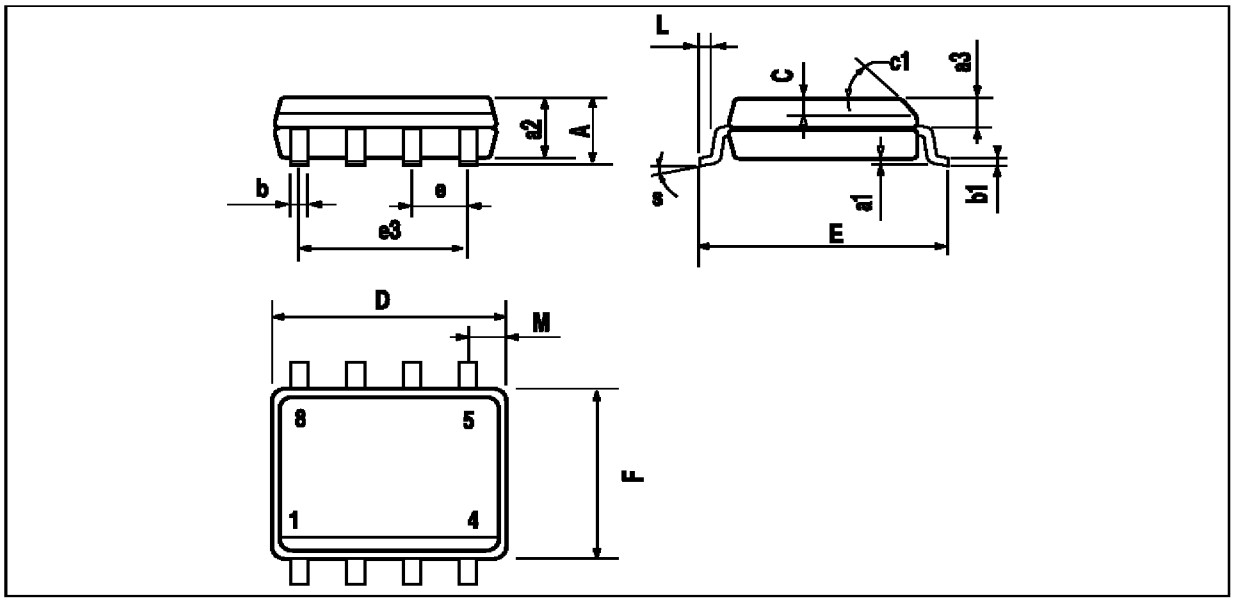
PACKAGE MECHANICAL DATA
8 PINS - PLASTIC PACKAGE



Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A		3.32			0.131	
a1	0.51			0.020		
B	1.15		1.65	0.045		0.065
b	0.356		0.55	0.014		0.022
b1	0.204		0.304	0.008		0.012
D			10.92			0.430
E	7.95		9.75	0.313		0.384
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			6.6			0260
i			5.08			0.200
L	3.18		3.81	0.125		0.150
Z			1.52			0.060

PACKAGE MECHANICAL DATA

8 PINS - PLASTIC MICROPACKAGE (SO)



Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
a1	0.1		0.25	0.004		0.010
a2			1.65			0.065
a3	0.65		0.85	0.026		0.033
b	0.35		0.48	0.014		0.019
b1	0.19		0.25	0.007		0.010
C	0.25		0.5	0.010		0.020
c1	45° (typ.)					
D	4.8		5.0	0.189		0.197
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		3.81			0.150	
F	3.8		4.0	0.150		0.157
L	0.4		1.27	0.016		0.050
M			0.6			0.024
S	8° (max.)					