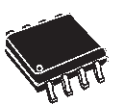
L4979D
L4979MD

LOW DROP VOLTAGE REGULATOR

PRODUCT PREVIEW

- OPERATING DC SUPPLY VOLTAGE RANGE 6V TO 31V
- TRANSIENT SUPPLY VOLTAGE UP TO 40V
- LOW QUIESCENT CURRENT CONSUMPTION LESS THAN 20µA WITH ENABLE LOW
- HIGH PRECISION OUTPUT VOLTAGE (2%)
- LOW DROPOUT VOLTAGE LESS THAN 0.5V
- RESET CIRCUIT SENSING THE OUTPUT VOLTAGE DOWN TO 1V
- PROGRAMMABLE RESET PULSE DELAY WITH EXTERNAL CAPACITOR
- WATCHDOG
- PROGRAMMABLE WATCHDOG TIMER WITH EXTERNAL CAPACITOR
- THERMAL SHUTDOWN AND SHORT CIRCUIT PROTECTION
- WIDE TEMPERATURE RANGE (T_j = -40°C TO 150°C)



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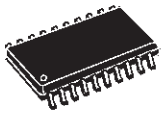


SO20

ORDERING NUMBERS:

L4979D **L4979MD**

DESCRIPTION

L4979 is a family of low dropout linear regulators with microprocessor control functions such as power on reset, low voltage reset, watchdog timer, on-off control or Enable. In addition, only low value ceramic capacitor is required for stability (above or equal to 100nF).

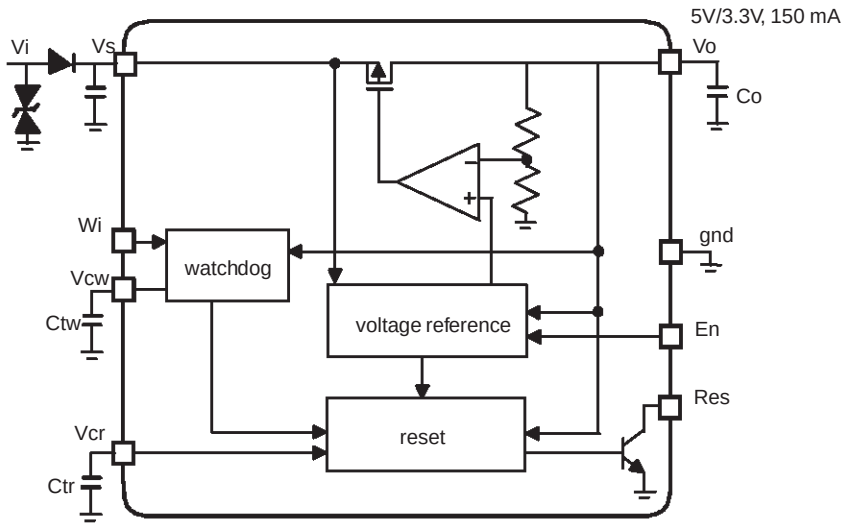
Maximum quiescent current is 20µA at all output current equal 0 and enable low.

Typical quiescent current is 1.5mA at output current equal to 5mA, 3mA at output current equal to 150mA, and drops to 10mA in "not enabled" mode.

On chip trimming results in high output voltage accuracy (2%). Accuracy is kept over wide temperature range, line variation, load variation.

The maximum input voltage is 40V. The maximum output current is 200mA. Output current is internally limited. Internal temperature protection disables voltage regulator at overtemperature.

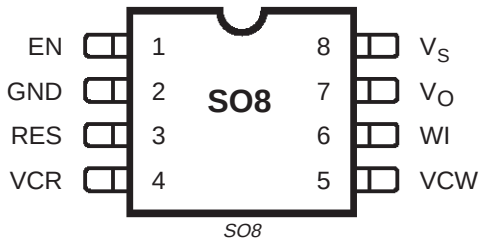
BLOCK DIAGRAM



PIN FUNCTION

SO8 N°	SO20 N°	Pin Name	Function
1	1	En	Voltage regulator enable
2	4, 5, 6, 15, 16	gnd	ground
3	7	Res	Reset output
4	10	Vcr	Reset timing adjust
5	11	Vcw	Watchdog timer adjust
6	14	Wi	Watchdog input
7	17	Vo	Voltage regulator output
8	20	Vs	Supply voltage
	2, 3, 8, 9, 12, 13, 18, 19	N. C.	not connected

PINS CONNECTION



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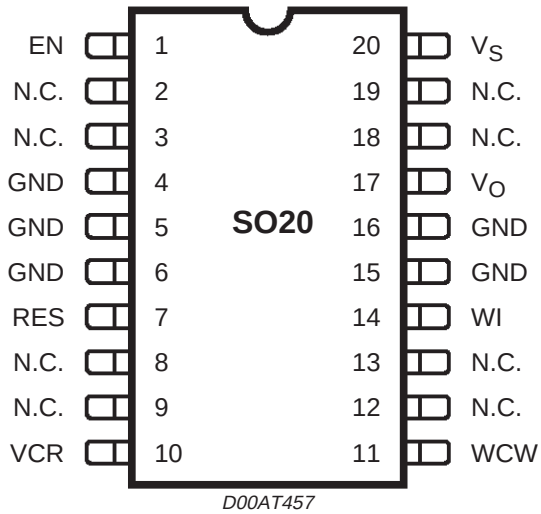


D00AT457

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
Vvsdc	DC operating supply voltage	31	V
Vvstr	Transient operating supply voltage (t<400ms)	-0.3 to 40	V
Ivsdc	Input current	internally limited	
Vvo	DC output voltage	-0.3 to 5.5	V
Ivo	DC output current	internally limited	
Vwi	Watchdog input voltage	-0.3 to 7	V
Vod	Open drain output voltage (RES)	-0.3 to 7	V
Iod	Open drain output current (RES)	internally limited	
Vcr	Reset delay voltage	-0.3 to 7	V
Vcw	Watchdog delay voltage	-0.3 to 7	V
Ven	Enable input voltage	-0.3 to 40	V
Tj	Junction temperature	-40 to 150	C
VESD	ESD voltage level (HBM-MIL STD 883C)	+/- 2	kV

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at any condition above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

THERMAL DATA

Symbol	Parameter	Value	Unit
$R_{th\ j\text{-}amb}$	Thermal resistance Junction to Ambient (SO8)	130-180	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance Junction to Ambient (SO12+4+4)	50 (*)	°C/W

(*) with 6 sq. cm on board heat sink

ELECTRICAL CHARACTERISTCS

(V_S = 5.6V to 31V, T_j = -40°C to +150°C unless otherwise specified)

Pin	Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
GENERAL							
V_S, V_O	I_q	Quiescent current	V_S = 13.5V, I_O=150mA, enable high all I/O currents=0		3	6	mA
V_S, V_O	I_q	Quiescent current	V_S = 13.5V, I_O = 0mA, enable high all I/O currents = 0		1.5	3	mA
V_S, V_O	I_q	Quiescent current	V_S = 13.5V, I_O = 0mA, enable low all I/O currents = 0			20	µA
	T_w	Thermal protection temperature		150		190	°C
	T_{w_hy}	Thermal protection temperature hysteresis			10		°C

ELECTRICAL CHARACTERISTICS (continued)

Pin	Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
5V VOLTAGE REGULATOR							
V_o	V_{o_ref}	Output voltage	V_s = 5.6 to 31V I_o = 1 to 150mA	4.90	5.00	5.10	V
V_o	I_{lim}	Output current limitation	V_s = 13.5V	200	300	400	mA
V_s, V_o	V_{line}	Line regulation voltage	V_s = 5.6 to 31V I_o = 1 to 150mA			25	mV
V_o	V_{load}	Load regulation voltage	I_o = 1 to 150mA			25	mV
V_s, V_o	V_{dp}	Drop voltage	I_o = 150mA		300	500	mV
V_s, V_o	SVR	Ripple rejection	f_r = 100 Hz	55			dB
3.3V VOLTAGE REGULATOR							
V_o	V_{o_ref}	Output voltage	V_s = 5.6 to 31V I_o = 1 to 150mA	3.23	3.30	3.37	V
V_o	I_{lim}	Output current limitation	V_s = 13.5V	200	300	400	mA
V_s, V_o	V_{line}	Line regulation voltage	V_s = 5.6 to 31V I_o = 1 to 150mA			25	mV
V_s, V_o	V_{dp}	Drop voltage	I_o = 150mA		500	1000	mV
V_o	V_{load}	Load regulation voltage	I_o = 1 to 150mA			25	mV
V_s, V_o	SVR	Ripple rejection	f_r = 100 Hz	55			dB
RESET (5V)							
R_{es}	V_{res_l}	Reset output low voltage	R_{ext} = 5kΩ to Vo, Vo > 1V			0.4	V
R_{es}	I_{res_h}	Reset output high leakage current	V_{res} = 5V			1	µA
R_{es}	$R_{\_p\_u}$	Pull up internal resistance	with respect to V_o	15	30	50	kΩ
R_{es}	V_{o_th}	V_o out of regulation threshold	V_s = 5.6 to 31V I_o = 1 to 150mA	6% below V_{o_ref}	8% below V_{o_ref}	10% below V_{o_ref}	
V_{cr}	V_{rhth}	Reset timing high threshold	V_s = 13.5V	10% V_{o_ref}	13% V_{o_ref}	16% V_{o_ref}	
V_{cr}	V_{rlth}	Reset timing low threshold	V_s = 13.5V	44% V_{o_ref}	47% V_{o_ref}	50% V_{o_ref}	
V_{cr}	I_{cr}	Charge current	V_s = 13.5V	8	17.6	30	µA
V_{cr}	I_{dr}	Discharge current	V_s = 13.5V	8	17.6	30	µA
R_{es}	t_{rr}	Reset reaction time	see fig. 2	4	10	30	µs
R_{es}	t_{rd}	Reset pulse delay	V_s = 13.5V, C_{tr} = 1nF	65		150	ms

ELECTRICAL CHARACTERISTICS (continued)

Pin	Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
RESET (3.3V)							
R_{es}	V_{res_l}	Reset output low voltage	R_{ext} = 5kΩ to V_o, V_o > 1V			0.4	V
R_{es}	I_{res_h}	Reset output high leakage current	V_{res} = 5V			1	µA
R_{es}	$R_{\_p\_u}$	Pull up internal resistance	with respect to V_o	15	30	50	kΩ
R_{es}	V_{o_th}	Vo out of regulation threshold	V_s = 5.6 to 31V I_o = 1 to 150mA	6% below V_{o_ref}	8% below V_{o_ref}	10% below V_{o_ref}	
V_{cr}	V_{rhth}	Reset timing high threshold	V_s = 13.5V	10% V_{o_ref}	13% V_{o_ref}	16% V_{o_ref}	
V_{cr}	V_{rlth}	Reset timing low threshold	V_s = 13.5V	44% V_{o_ref}	47% V_{o_ref}	50% V_{o_ref}	
V_{cr}	I_{cr}	Charge current	V_s = 13.5V	8	17.6	30	µA
V_{cr}	I_{dr}	Discharge current	V_s = 13.5V	8	17.6	30	µA
R_{es}	t_{rr}	Reset reaction time	see fig. 2	3	7.5	20	µs
R_{es}	t_{rd}	Reset pulse delay	V_s = 13.5V, C_{tr} = 1nF	40	65	100	ms
WATCHDOG (5V)							
W_i	V_{ih}	Input high voltage	V_s = 13.5V	3.5			V
W_i	V_{il}	Input low voltage	V_s = 13.5V			1.5	V
W_i	V_{ih}	Input hysteresis	V_s = 13.5V		100		mV
W_i	I_i	Pull down current	V_s = 13.5V		10		µA
V_{cw}	V_{whth}	High threshold	V_s = 13.5V	2.20	2.35	2.50	V
V_{cw}	V_{wlth}	Low threshold	V_s = 13.5V	0.50	0.65	0.80	V
V_{cw}	I_{cwc}	Charge current	V_s = 13.5V, V_{cw} = 0.1V	4	8	14	µA
V_{cw}	I_{cwd}	Discharge current	V_s = 13.5V, V_{cw} = 2.5V	1.0	2.13	4.5	µA
V_{cw}	T_{wop}	Watchdog period	V_s = 13.5V, C_{tw} = 47nF	20	48	80	ms
R_{es}	t_{wol}	Watchdog output low time	V_s = 13.5V, C_{tw} = 47nF	5	10	18	ms
WATCHDOG (3.3V)							
W_i	V_{ih}	Input high voltage	V_s = 13.5V	2.3			V
W_i	V_{il}	Input low voltage	V_s = 13.5V			1	V
W_i	V_{ih}	Input hysteresis	V_s = 13.5V		50		mV
W_i	I_i	Pull down current	V_s = 13.5V		10		µA

ELECTRICAL CHARACTERISTICS (continued)

Pin	Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_{cw}	V_{whth}	Watchdog timing high threshold	V_s = 13.5V	1.45	1.55	1.65	V
V_{cw}	V_{wlth}	Watchdog timing low threshold	V_s = 13.5V	0.30	0.45	0.55	V
V_{cw}	I_{cwc}	Charge current	V_s = 13.5V, V_{cw} = 0.1V	4	8	14	µA
V_{cw}	I_{cwd}	Discharge current	V_s = 13.5V, V_{cw} = 2.5V	1.0	2.13	4.5	µA
V_{cw}	T_{wop}	Watchdog period	V_s =13.5V, C_{tw} = 47nF	13	32	54	ms
R_{es}	t_{wol}	Watchdog output low time	V_s = 13.5V, C_{tw} = 47nF	3.0	6.5	11.0	ms
ENABLE (5V)							
E_n	V_{en_l}	Enable input low voltage		2.1			V
E_n	V_{en_h}	Enable input high voltage				3.4	V
E_n	V_{en_hy}	Enable input hysteresis		0.25			V
E_n	$I_{\_leak}$	Pull down current	E_n = 5V	5	20	40	µA
ENABLE (3.3V)							
E_n	V_{en_l}	Enable input low voltage		2.0			V
E_n	V_{en_h}	Enable input high voltage				2.7	V
E_n	V_{en_hy}	Enable input hysteresis		0.2			V
E_n	$I_{\_leak}$	Pull down current	E_n = 5V	5	20	40	µA

VOLTAGE REGULATOR

Voltage regulator uses a pchannel transistor as a regulating element. With this structure very low dropout voltage at current up to 150mA is obtained. The output voltage is regulated up to transient input supply voltage of 40V. No functional interruption due to over-voltage pulses is generated. The high precision of the output voltage is obtained with a pre-trimmed reference voltage. A short circuit protection to GND is provided.

RESET

The reset circuit supervises the output voltage V_o. The V_{o_th} reset threshold is defined with the internal reference voltage and a resistor output divider. If the output voltage becomes lower than Vo_th then Res goes low with a reaction time trr. If the output voltage becomes lower than 2.0V (typ) than Res goes immediately low. The reset low signal is guaranteed for an output voltage V_o greater than 1V.

When the output voltage becomes higher than V_{o_th} then Res goes high with a delay t_{rd}. This delay is obtained by an internal oscillator. Oscillator period is given by

$$T_{osc} = \frac{[(V_{rhth} - V_{rlth}) \cdot C_{tr}]}{I_{cr}} + \frac{[(V_{rhth} - V_{rlth}) \cdot C_{tr}]}{I_{cd}}$$

where:

I_{cr} is an internally generated charge current,

I_{cd} is an internally generated discharge current,

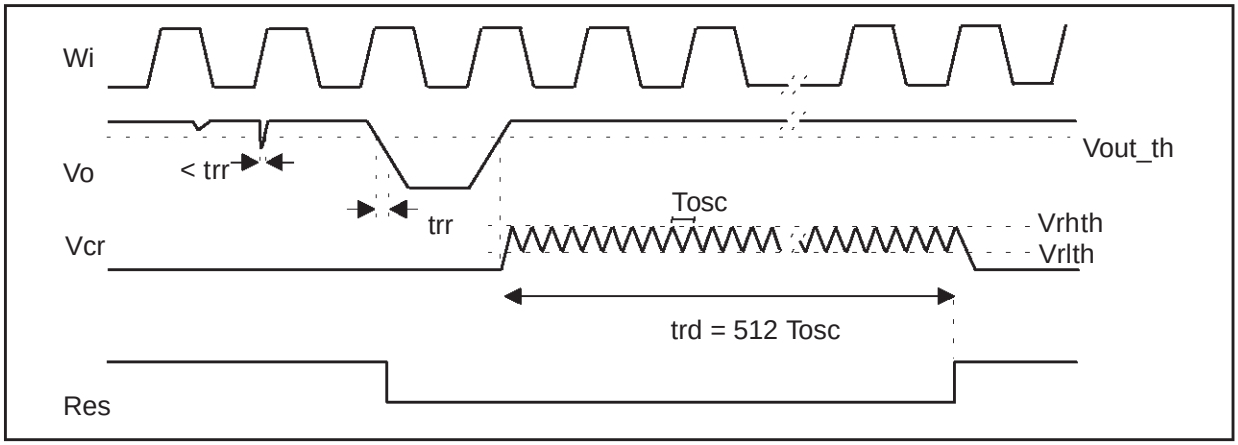
V_{rhth} and Vrlth are two voltages defined with the output voltage and a resistor output divider,

C_{tr} is an external capacitance,

t_{rd} is given by

$t_{rd} = 512 \times T_{osc}$

Figure 1. Reset Time Diagram.



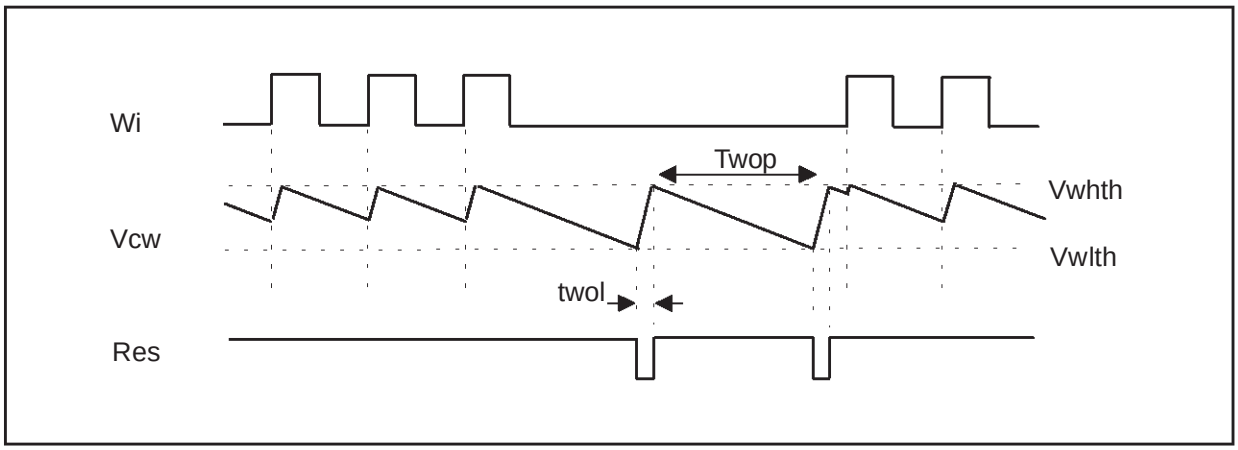
WATCHDOG

A connected microcontroller is monitored by the watchdog input W_i. If pulses are missing, the watchdog output W_o is set to low. The pulse sequence time can be set within a wide range with the external capacitor C_{tw}. The watchdog circuit discharges the capacitor C_{tw} with the constant current I_{cwd}. If the lower threshold V_{wlth} is reached, a watchdog reset is generated. To prevent this the microcontroller must generate a positive edge during the discharge of the capacitor before the voltage has reached the threshold V_{wlth}. In order to calculate the minimum time t during which the microcontroller must output the positive edge the following equation can be used:

$$(V_{whth} - V_{wlth}) \times C_{tw} = I_{cwd} \times t$$

Every W_i positive edge switches the current source from discharging to charging, the same happens when the lower threshold is reached. When the voltage reaches the upper threshold V_{whth} the current switches from charging to discharging. The result is a saw toothvoltage at the watchdog timer capacitor C_{tw}.

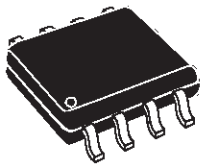
Figure 2. Watchdog time diagram



DIM.	mm			inch		
	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 (1)	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 (1)	3.8		4.0	0.15		0.157
L	0.4		1.27	0.016		0.050
M			0.6			0.024
S	8° (max.)					

(1) D and F do not include mold flash or protrusions. Mold flash or potrusions shall not exceed 0.15mm (.006inch).

OUTLINE AND MECHANICAL DATA



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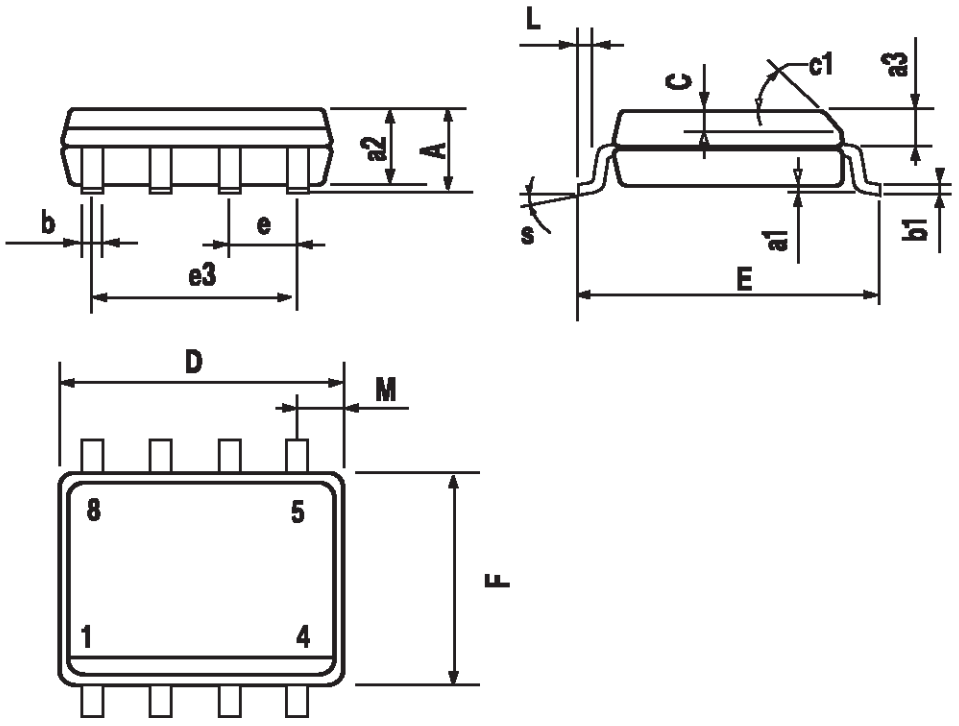
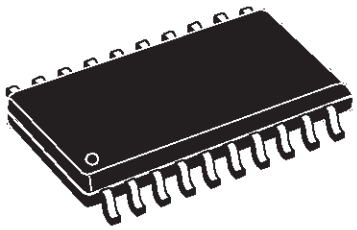


DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.35		2.65	0.093		0.104
A1	0.1		0.3	0.004		0.012
B	0.33		0.51	0.013		0.020
C	0.23		0.32	0.009		0.013
D	12.6		13	0.496		0.512
E	7.4		7.6	0.291		0.299
e		1.27			0.050	
H	10		10.65	0.394		0.419
h	0.25		0.75	0.010		0.030
L	0.4		1.27	0.016		0.050
K	0° (min.)8° (max.)					

OUTLINE AND MECHANICAL DATA



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