DESCRIPTION

The A4051 is a complete constant current & constant voltage linear charger for single cell lithium-ion batteries. Its PSOP8 package and low external component count make the A4051 ideally suited for portable applications. Furthermore, the A4051 is specifically designed to work within USB power specifications.

No external sense resistor is needed, and no blocking diode is required due to the internal MOSFET architecture. Thermal feedback regulates the charge current to limit the die temperature during high power operation or high ambient temperature. The charge voltage is fixed at 4.2V, and the charge current can be programmed externally with a single resistor. The A4051 automatically terminates the charge cycle when the charge current drops to 1/10th the programmed value after the final float voltage is reached.

When the input supply (wall adapter or USB supply) is removed, the A4051 automatically enters a low current state, dropping the battery drain current to less than 0.5uA. The A4051 can be put into shutdown mode, reducing the supply current to 50uA.

Other features include Battery temperature monitor, under-voltage lockout, automatic recharge and two status pins to indicate charge and charge termination.

The A4051 is available in PSOP8 package

ORDERING INFORMATION

Package Type	Part Number	
PSOP8 SPQ: 4,000pcs/Reel	MP8	A4051MP8R
		A4051MP8VR
Note	V: Halogen free package R: Tape & Reel	
AiT provides all RoHS products		

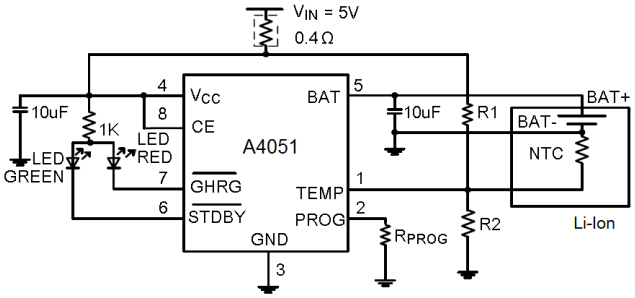
FEATURES

- Programmable Charge Current Up to 1000mA
- 1/10th of the constant charge current
- No MOSFET, Sense Resistor or Blocking Diode Required
- Complete Linear Charger in PSOP8 Package for single Cell Lithium-Ion Batteries
- Constant-Current/Constant-Voltage Operation with Thermal Regulation to Maximize Charge Rate Without Risk of Overheating
- Charges Single Cell Li-Ion Batteries Directly from USB Port
- Preset 4.2V Charge Voltage
- Charge Current Monitor Output for Gas Gauging
- Automatic Recharge
- Charge state pairs of output, no battery and fault status display
- C/10 Charge Termination
- 50uA Supply Current in Shutdown
- 2.9V Trickle Charge Threshold
- Soft-Start Limits Inrush Current
- Battery temperature monitoring function
- Available in PSOP8 package

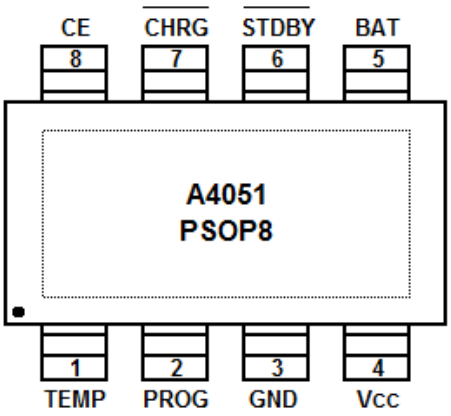
APPLICATION

- Cellular Telephones, PDAs, MP3 /MP4 Players
- Charging Docks and Cradles
- Bluetooth 、GPS Applications

TYPICAL APPLICATION



PIN DESCRIPTION



Top View

Pin #	Symbol	Function
1	TEMP	Battery temperature detection input. TEMP pin to receive the battery NTC sensor output. If the TEMP pin voltage is less than the input voltage is greater than 45% or 80% of the input voltage means the battery temperature is too low or too high, then the charge has been suspended. If the TEMP direct access GND, battery temperature detection canceled, the other charged and functioning properly.
2	PROG	Charge Current Program, Charge Current Monitor and Shutdown Pin. The charge current is programmed by connecting a 1% resistor, R_{PROG}, to ground. When charging in trickle-current mode, this pin servos to 0.1V.When charging in constant-current mode, this pin servos to 1V. In all modes, the voltage on this pin can be used to measure the charge current using the following formula: $I_{BAT} = (V_{PROG}/R_{PROG}) \cdot 1000$. The PROG pin can also be used to shut down the charger. Disconnecting the program resistor from ground allows a 3uA current to pull the PROG pin high. When it reaches the 1.21V shutdown threshold voltage, the charger enters shutdown mode, charging stops and the input supply current drops to 50uA. This pin is also clamped to approximately 2.4V. Driving this pin to voltages beyond the clamp voltage will draw currents as high as 1.5mA. Reconnecting R_{PROG} to ground will return the charger to normal operation.
3	GND	Ground
4	V_{CC}	Positive Input Supply Voltage. Provides power to the charger, V_{CC} can range from 4.25V to 6.5V and should be bypassed with at least a 10uF capacitor. When V_{CC} drops to within 30mV of the BAT pin voltage, the A4051 enters shutdown mode, dropping I_{BAT} to less than 2uA.
5	BAT	Charge Current Output. Provides charge current to the battery and regulates the final float voltage to 4.2V. An internal precision resistor divider from this pin sets the float voltage which is disconnected in shutdown mode.
6	$\overline{STDBY}$	The completion of battery charging instructions side. When the battery charge is complete, STDBY pulled low by internal switches, indicating the completion of charging. In addition, STDBY pin will be in a high-impedance state.
7	$\overline{CHRG}$	Open-Drain Charge Status Output. When the battery is charging, the CHRG pin is pulled low by an internal N-channel MOSFET. When the charge cycle is completed, CHRG pin will be in a high-impedance state.
8	CE	Chip enable input. High input level would A4051 is in normal working condition; low input level so that A4051 is prohibited charging status. CE pin can be TTL or CMOS level-level driver.

ABSOLUTE MAXIMUM RATINGS

V_{CC}, Input Supply Voltage	V_{SS}-0.3 V ~ V_{SS}+8V
V_{PROG}, PROG pin Voltage	V_{SS}-0.3 V ~ V_{CC}+0.3V
V_{BAT}, BAT pin Voltage	V_{SS}-0.3 V ~ 8V
V_{CHRG}, CHAG pin Voltage	V_{SS}-0.3V ~ V_{SS}+8V
I_{BAT}, BAT pin Current	1400mA
I_{PROG}, PROG pin Current	1400uA
T_{OPA}, Operating Ambient Temperature	-40℃ ~ +85℃
T_{STR}, Storage Temperature	-65℃ ~ +125℃
Lead Temperature (Soldering, 10s)	260℃

Stresses above may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the Electrical Characteristics are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

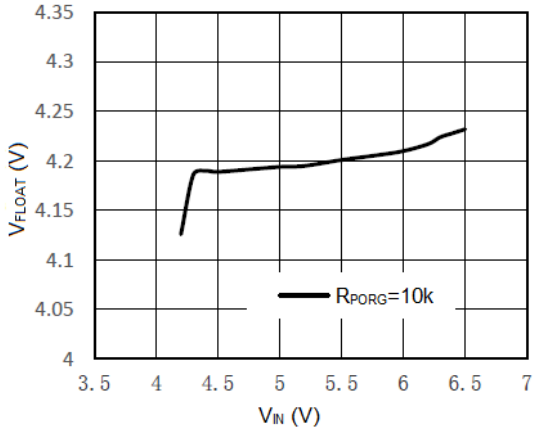
ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Supply Voltage	V_{CC}		4.25	-	6.5	V
Input Supply Current	I_{CC}	Charge mode, R_{PROG}=10k	-	350	2000	uA
		Standby mode	-	150	500	uA
		Shutdown mode (R_{PROG} not connected, V_{CC}<V_{BAT} or V_{CC}<V_{UV})	-	50	100	uA
Regulated Output Voltage	V_{FLOAT}	T_A=25°C, I_{BAT}=40mA	4.177	-	4.263	V
BAT Pin Current	I_{BAT}	R_{PROG} =2k,Current mode	450	500	550	mA
		R_{PROG} =1k,Current mode	900	1000	1100	
		Standby mode, V_{BAT}=4.3V	0	-2.5	-6	uA
		Shutdown mode	-	-1	-2.5	
		Sleep mode, V_{CC}=0V	-	-0.05	-0.5	
Trickle Charge Current	I_{TRIKL}	V_{BAT}<V_{TRIKL}, R_{PROG}=1k	90	100	110	mA
Trickle Charge Threshold Voltage	V_{TRIKL}	R_{PROG} =10k, V_{BAT} Rising	2.78	2.9	3.0	V
Trickle Voltage Hysteresis Voltage	V_{TRHYS}	R_{PROG} =10k	118	135	157	mV

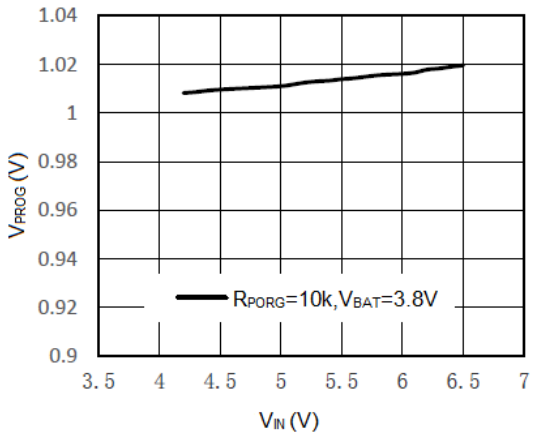
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
V_{CC} Undervoltage Lockout Threshold	V_{UV}	From V_{CC} low to high	3.6	3.8	3.93	V
V_{CC} Undervoltage Lockout Hysteresis	V_{UVHYS}		150	200	300	mV
V_{CC}-V_{BAT} Lockout Threshold Voltage	V_{ASD}	V_{CC} from low to high	-	250	-	mV
		V_{CC} from high to low	5	100	-	
C/10 Termination Current Threshold	I_{TERM}	R_{PROG}=1k	0.085	0.11	0.125	mA/mA
		R_{PROG}=2k	0.085	0.11	0.125	
PROG pin Voltage	V_{PROG}	R_{PROG} =1k, Current mode	0.93	1.0	1.07	V
CHRG pin Output Low Voltage	V_{CHRG}	I_{CHRG}=2.5mA	-	0.35	0.8	V
STDBY pin Output Low Voltage	V_{STDBY}	I_{STDBY}=2.5mA	-	0.35	0.8	V
Recharge Battery Threshold Voltage	ΔV_{RECG}	V_{FLOAT} - V_{RECHRG}	50	100	200	mV
CE High Voltage	V_{CE-H}		1.2	-	-	V
CE Low Voltage	V_{CE-L}		-	-	0.6	V
TEMP pin Voltage of The High-end Flip	V_{TEMP-H}		-	80	82	%V_{CC}
TEMP Pin Voltage of The Low-end Flip	V_{TEMP-L}		42	45	-	%V_{CC}
Limited Temperature Patterns in The Junction Temperature	T_{LIM}		-	145	-	℃

TYPICAL CHARACTERISTICS

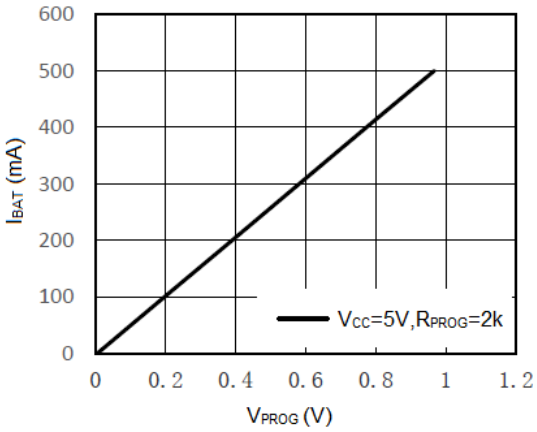
1. V_{FLOAT} vs. V_{IN}



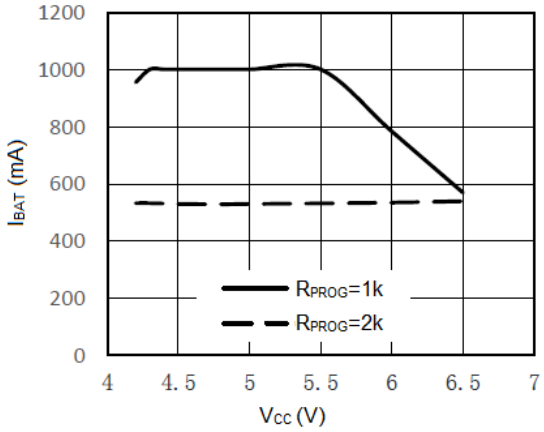
2. V_{PROG} vs. V_{IN}



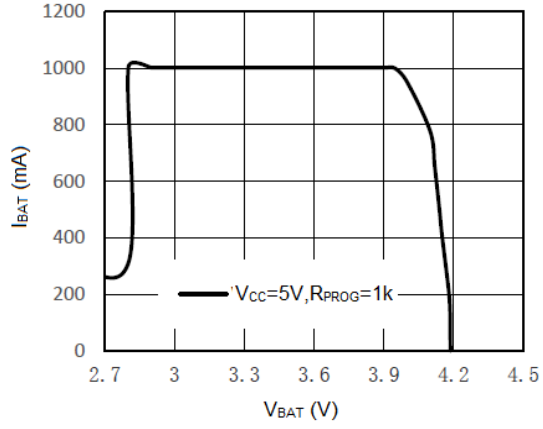
3. Charge Current vs. V_{PROG}



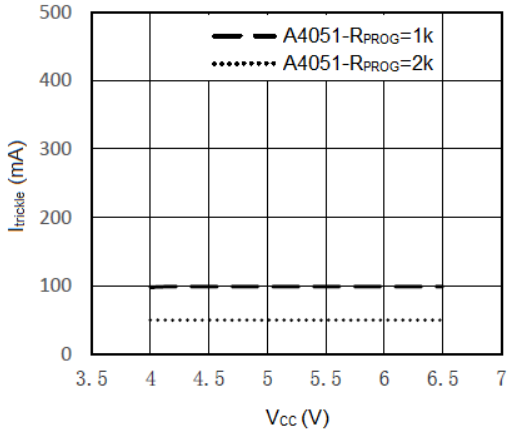
4. I_{BAT} vs. V_{CC}



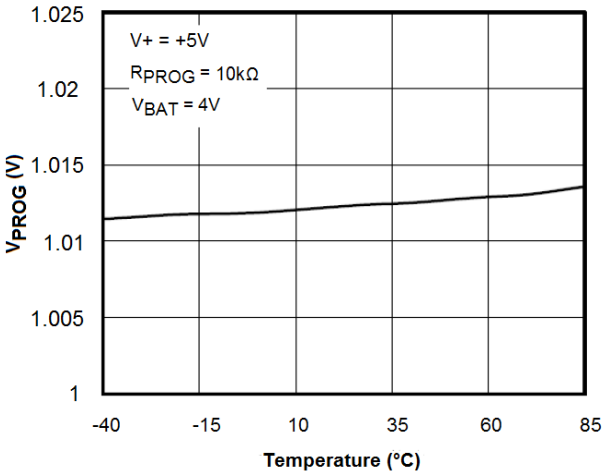
5. I_{BAT} vs. V_{BAT}



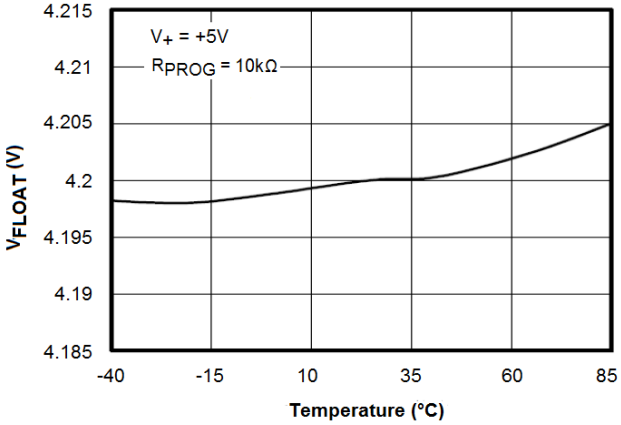
6. $I_{trickle}$ vs. V_{CC}



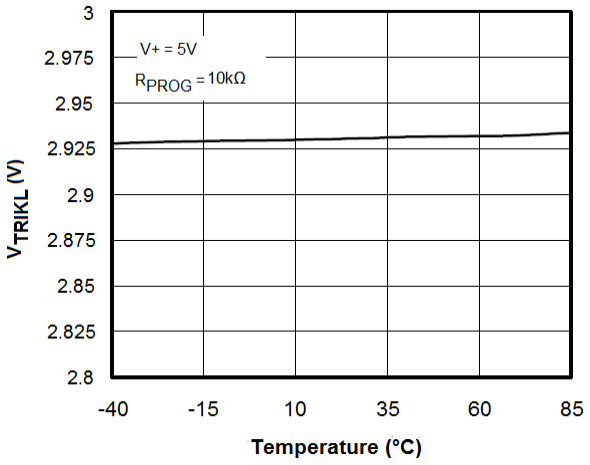
7. PROG Pin Voltage vs. Temp



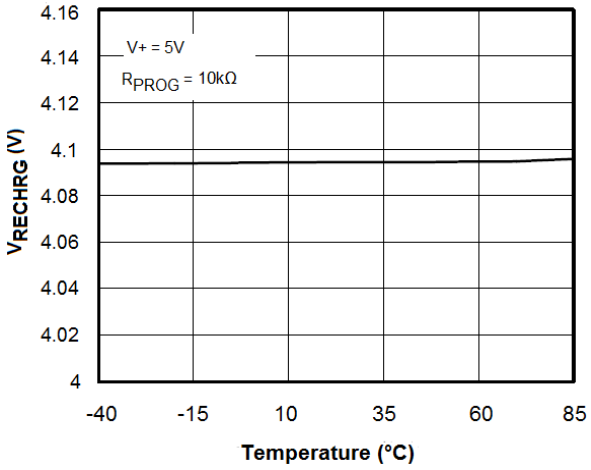
8. Regulated Output (Float) Voltage vs. Temp



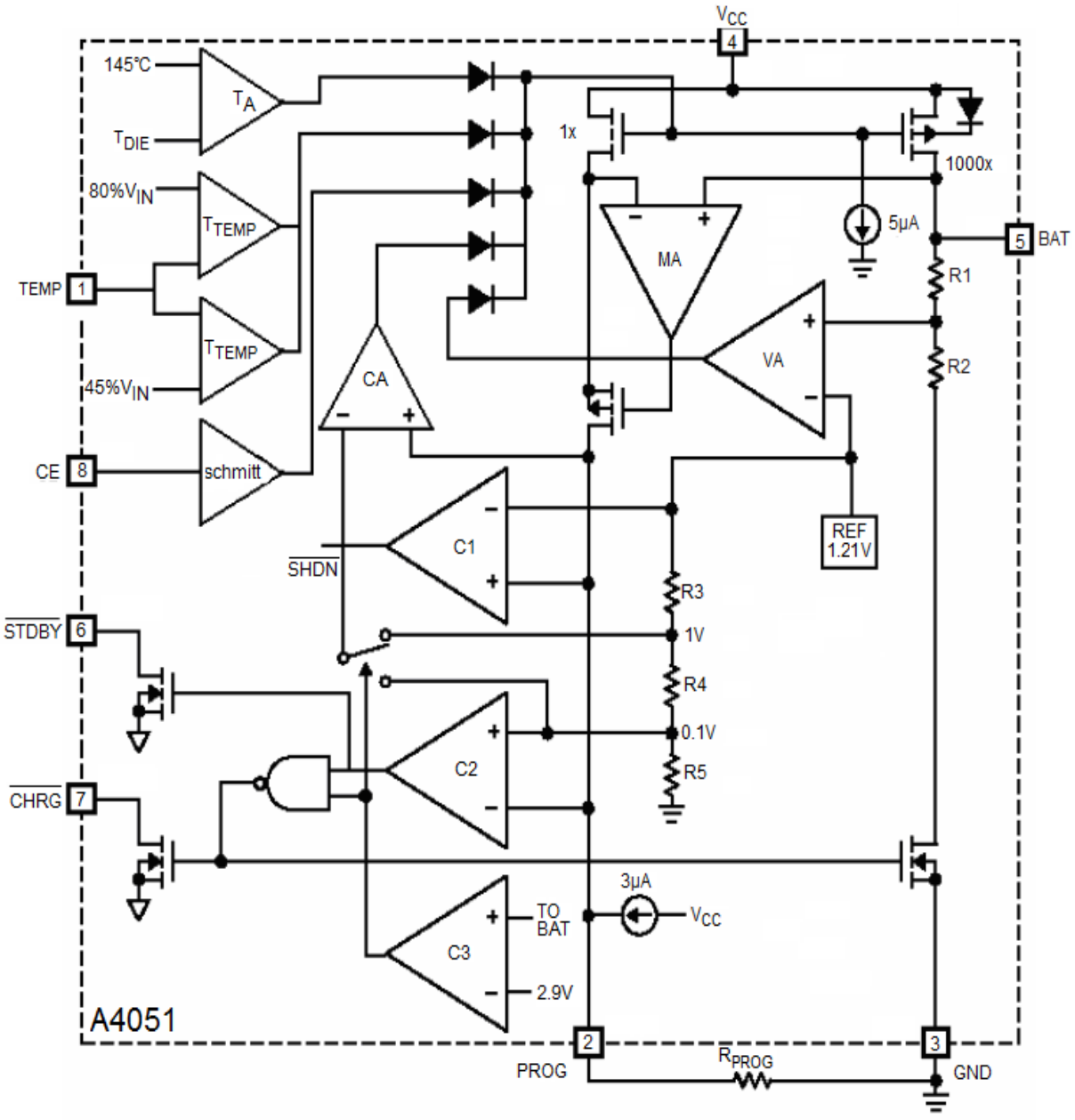
9. Trickle Charge Threshold vs. Temperature



10. Recharge Voltage Threshold vs. Temperature

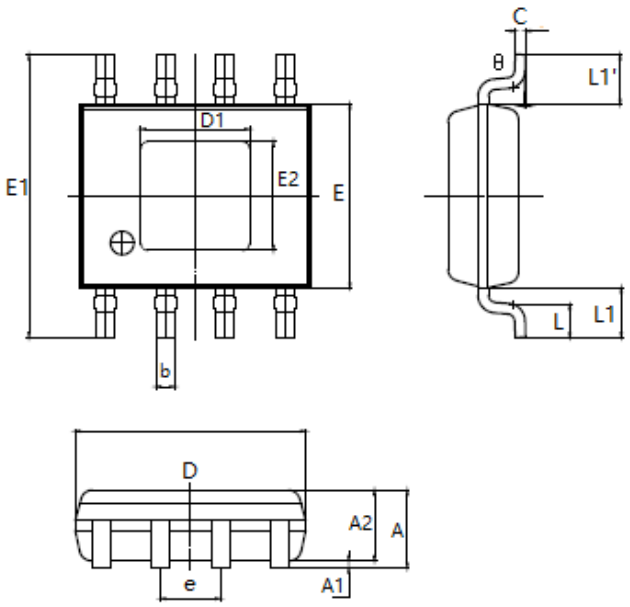


BLOCK DIAGRAM



PACKAGE INFORMATION

Dimension in PSOP8 Package (Unit: mm)



Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.050	0.150	0.002	0.006
A2	1.350	1.550	0.053	0.061
b	0.306	0.510	0.012	0.020
C	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.200
D1	2.170	2.400	0.085	0.094
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	2.172	2.400	0.090	0.099
e	1.270 ± 0.13		0.050 ± 0.005	
L	0.400	1.270	0.016	0.050
L1	1.025 ± 0.2		0.0404 ± 0.007	
L1-L1´	-	0.12	-	0.005
θ	0°	8°	0°	8°

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