



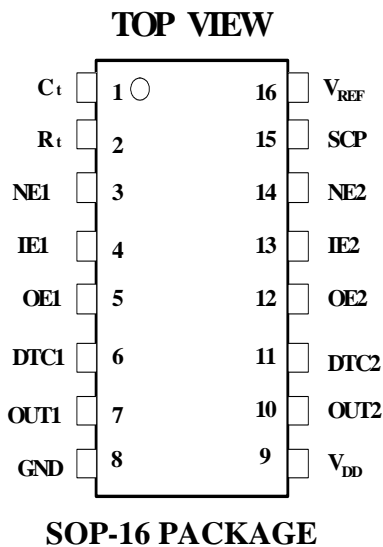
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2-CHANNEL SWITCHING REGULATOR

FEATURES

- Complete PWM Power Control Circuitry
- Under-Voltage Lockout (UVLO) Protection
- Open Drain Output
- Output Short Circuit Protection
- Low Dissipation Current : 1.6mA
- Dead-Time Control : 0% to 100%
- Wide Operating Frequency :
10 kHz to 800 kHz
- V_{DD} Range : 4.0V to 14.0V

PIN CONFIGURATION



GENERAL DESCRIPTION

The AAT1351 provides an integrated two-channel pulse-width-modulation (PWM) solution for the power supply of DC-DC system; this device offers the systems engineer flexibility to tailor-make the power supply circuitry for specific applications. Each channel contains its own error amplifier, PWM comparator, dead-time control (DTC) and output driver. The under-voltage protection, oscillator, short circuit protection and voltage reference circuit are the common features for the two channels.

Both channels of AAT1351 can be used for DC-DC converter operations including step-up, step-down, and inverting. Dead-time control can be set to provide 0% to 100% dead-time through a resistive divider network. Soft-start can be implemented by paralleling the DTC resistor with a capacitor. Two dead-time control inputs are assigned for channel 1 (CH1) and channel 2 (CH2) individually, and dead-time control inputs can be used to control on / off operation.

With a minimum number of external components, the AAT1351 offers a simple and cost effective solution.

**PIN DESCRIPTION**

PIN NO	NAME	I/O	DESCRIPTION
1	C_t	I	External Timing Capacitance
2	R_t	I	External Timing Resistance
3	NE1	I	Noninverting Input of Error Amplifier 1
4	IE1	I	Inverting Input of Error Amplifier 1
5	OE1	I	Output of Error Amplifier 1
6	DTC1	I	Output 1 Dead-Time / Soft-Start Setting
7	OUT1	O	Output 1
8	GND		Ground
9	V_{DD}	I	Power Supply
10	OUT2	O	Output 2
11	DTC2	I	Output 2 Dead-Time / Soft-Start Setting
12	OE2	I	Output of Error Amplifier 2
13	IE2	I	Inverting Input of Error Amplifier 2
14	NE2	I	Noninverting Input of Error Amplifier 2
15	SCP	I	Timer Latch Setting
16	V_{REF}	O	Reference Voltage (2.5V) Output

**ABSOLUTE MAXIMUM RATINGS**

CHARACTERISTICS	SYMBOL	VALUE	UNIT
Supply Voltage	V_{DD}	14.0	V
Input Voltage (IE -, DTC)	V_I	V_{DD}	V
Output Voltage	V_O	$V_{DD}+0.3$	V
Output Current	I_O	120	mA
Operating Free-Air Temperature Range	T_C	- 20 to +85	°C
Storage Temperature Range	$T_{storage}$	- 45 to +125	°C
Power Dissipation	P_d	500	mW

RECOMMENDED OPERATING CONDITIONS

	SYMBOL	MIN	MAX	UNIT
Supply Voltage, V_{DD}	V_{DD}	4.0	14.0	V
Input Voltage, IE1, IE2	V_{cm}	0.5	1.6	V
Output Voltage	V_O	0	V_{DD}	V
Oscillator (OSC) Capacitance	C_{OSC}	100	15,000	pF
Oscillator (OSC) Resistance	R_{OSC}	5.1	50.0	k Ω
Oscillator (OSC) Frequency	f_{OSC}	10	800	kHz
Output Current, I_{OUT1} , I_{OUT2}	I_O	-	100	mA
Operating Free-Air Temperature	T_C	- 20	85	°C

**ELECTRICAL CHARACTERISTICS, $V_{DD} = 6.0V$ (UNLESS OTHERWISE SPECIFIED) (SEE NOTE 1)****OSCILLATOR**

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
Frequency	f_{OSC}	$C_{OSC} = 330pF,$ $R_{OSC} = 10k\Omega$	160	200	240	kHz
Frequency Changes with V_{DD}	$f_{\Delta V}$	$V_{DD} = 4.0V$ to $14.0V,$ $T_C = 25^\circ C$ $C_{OSC} = 330pF,$ $R_{OSC} = 10k\Omega$	-	1	-	%

UNDER VOLTAGE PROTECTION

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
Upper Threshold Voltage	V_{UPH}	$T_C = 25^\circ C$	-	2.9	-	V
Lower Threshold Voltage	V_{UPL}	$T_C = 25^\circ C$	-	2.53	-	V
Hysteresis ($V_{UPH} - V_{UPL}$)	V_{HYS}	$T_C = 25^\circ C$	-	0.37	-	V

SHORT CIRCUIT PROTECTION CONTROL

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
Input Threshold Voltage	V_{r1}	CH1, CH2	-	1.18	-	V
Short Circuit Detect Threshold Voltage	V_{r2}		0.65	0.70	0.75	V
SCP Terminal Source Current	I_{SCP}		-20	-15	-10	μA
Stand-by Voltage	V_{STB}		-	50	100	mV
Latch Voltage	V_{LT}		-	30	100	mV

Note 1: Typical values of all parameters are specified at $T_C = 25^\circ C$.



ELECTRICAL CHARACTERISTICS, $V_{DD} = 6.0V$ (UNLESS OTHERWISE SPECIFIED) (SEE NOTE 1) (CONT.)

REFERENCE VOLTAGE

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
Reference Voltage	V_{REF}	$I_{REF} = -1mA, T_C = 25^\circ C$	2.4	2.5	2.6	V
Input Voltage Regulation	V_{RI}	$I_{REF} = -1mA,$ $V_{DD} = 4.0V$ to $14.0V$	-	1	5	mV
Output Regulation	V_{RO}	$I_{REF} = -0.1mA$ to $-3.0mA$	-	1	10	mV

EA (ERROR AMPLIFIER)

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
Input Offset Voltage	V_{IO}	CH1, CH2, Unity Gain	-	-	6	mV
Input Bias Current	I_{IB}	CH1, CH2	-	± 15	± 100	nA
Input Voltage Range	V_{IR}	CH1, CH2	0.5	-	1.6	V
Open-Loop Voltage Gain	A_{VO}		70	85	-	dB
Output Voltage Swing	V_{OS+}		2.3	2.5	-	V
	V_{OS-}		-	0.7	0.9	
Output Sink Current	I_{OS+}	OE=1.25V	3	20	-	mA
Output Source Current	I_{OS-}	OE=1.25V	-75	-45	-	μA
Common-Mode Rejection Ratio	CMRR		60	80	-	dB

**ELECTRICAL CHARACTERISTICS, $V_{DD} = 6.0V$ (UNLESS OTHERWISE SPECIFIED) (SEE NOTE 1) (CONT.)****DEAD-TIME CONTROL & PWM**

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
Input Bias Current	I_{IB}	$V_{DTC} = 2V$	-	0.1	1.0	μA
Input Threshold Voltage (DTC)	V_{d0}	Duty = 0%, $f_{OSC} = 10kHz$	1.79	1.97	2.15	V
	V_{d100}	Duty = 100%, $f_{OSC} = 10kHz$	1.32	1.48	1.64	
Latch Input Voltage	V_{DTC}	$I_{DT} = 40\mu A$	2.28	2.48	-	V
Latch Mode Source Current	I_{DTC}	DTC1, DTC2=0V	-560	-200	-	μA

OUTPUT STAGE

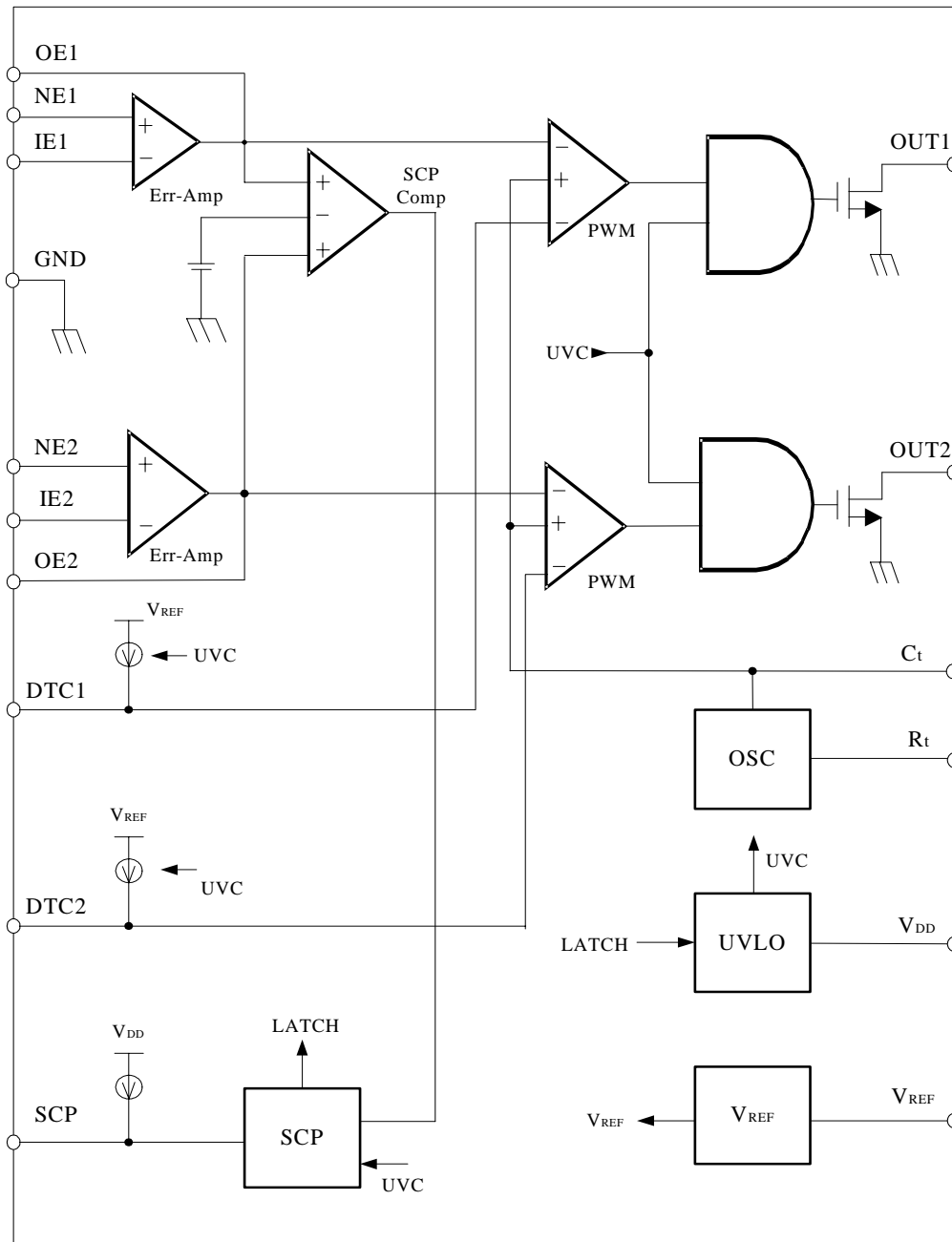
PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
Saturation Voltage	V_{SAT}	$I_O = 75mA$ (CH1, CH2)	-	0.8	1.2	V
Leakage Current	I_{LEAK}	$V_O = 14.0V$	-	-	5	μA

OPERATING CURRENT

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
Supply Current	I_{DD-OFF}	Output "OFF" State	-	1.3	1.8	mA
	I_{DD-ON}	$R_{OSC} = 10k\Omega$	-	1.6	2.4	mA

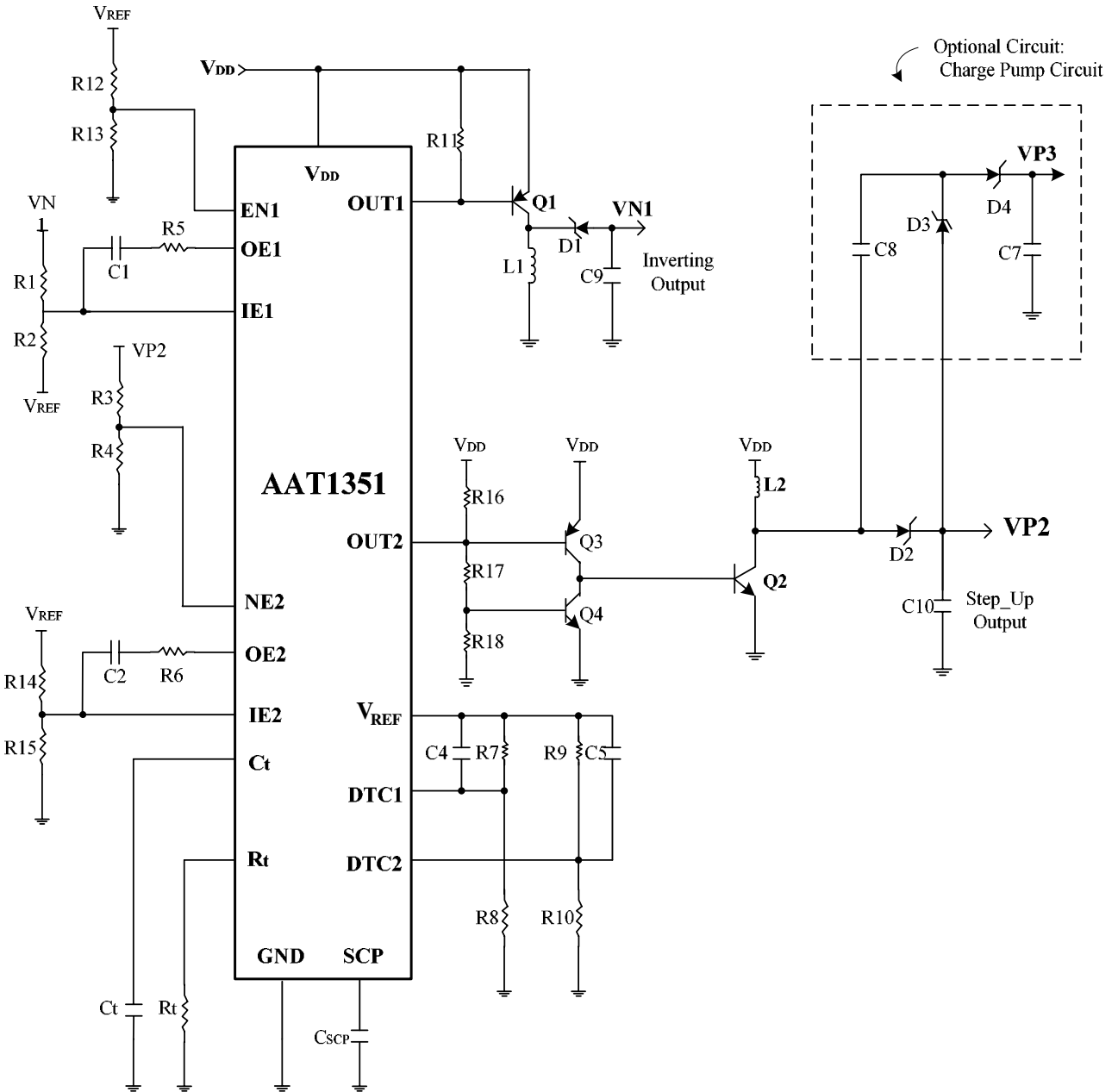


BLOCK DIAGRAM



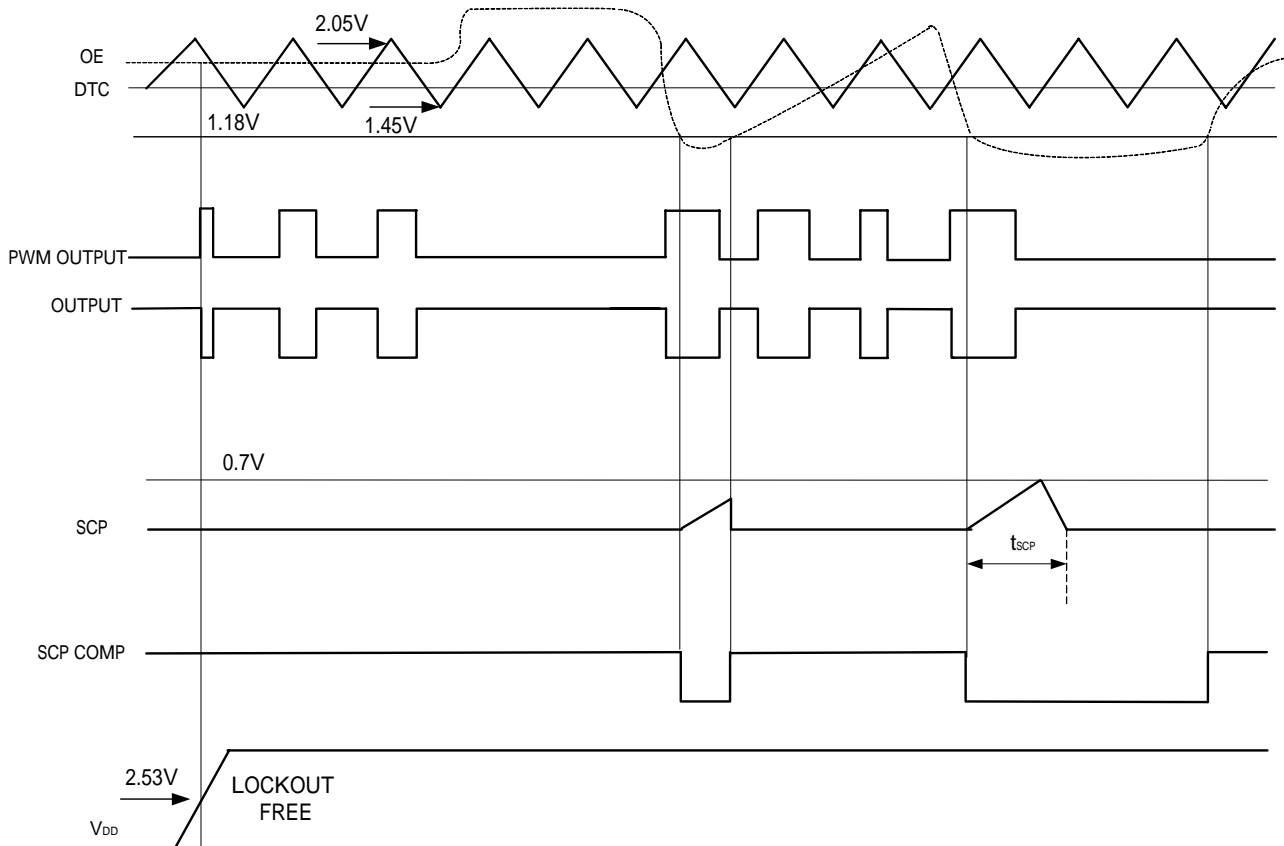


APPLICATION CIRCUIT





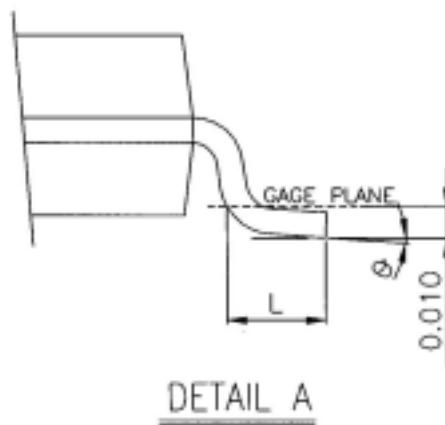
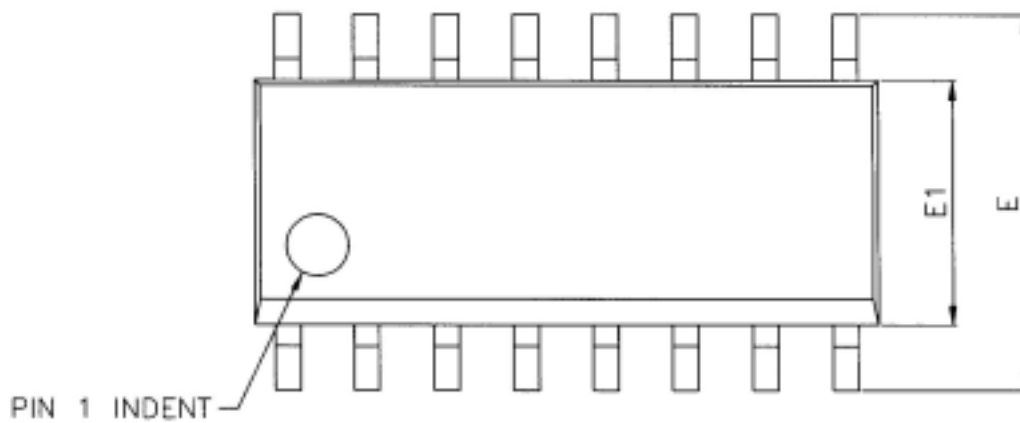
TIMING CHART



Note: $t_{SCP} \cong \frac{C_{SCP} V_{r2}}{I_{SCP}}$

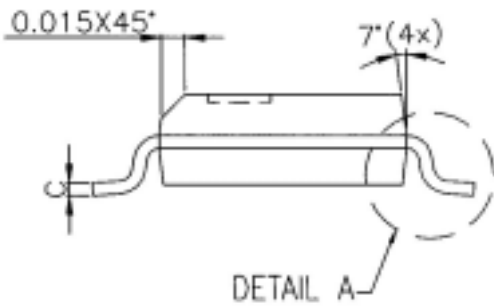
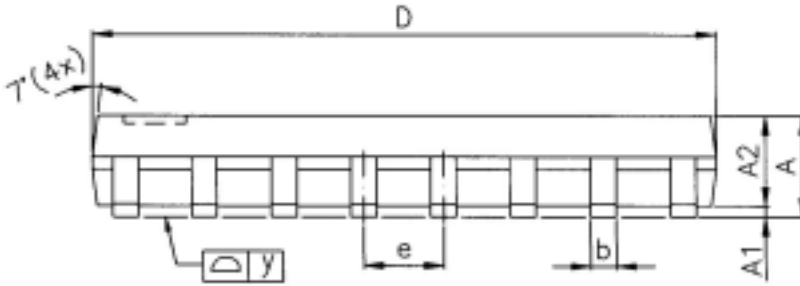


PACKAGE DIMENSION
16-PIN SOP





PACKAGE DIMENSION (CONT.)





PACKAGE DIMENSION (CONT.)

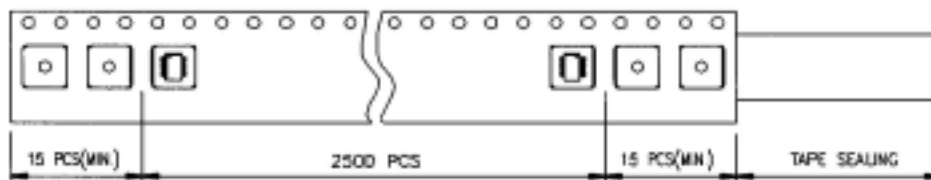
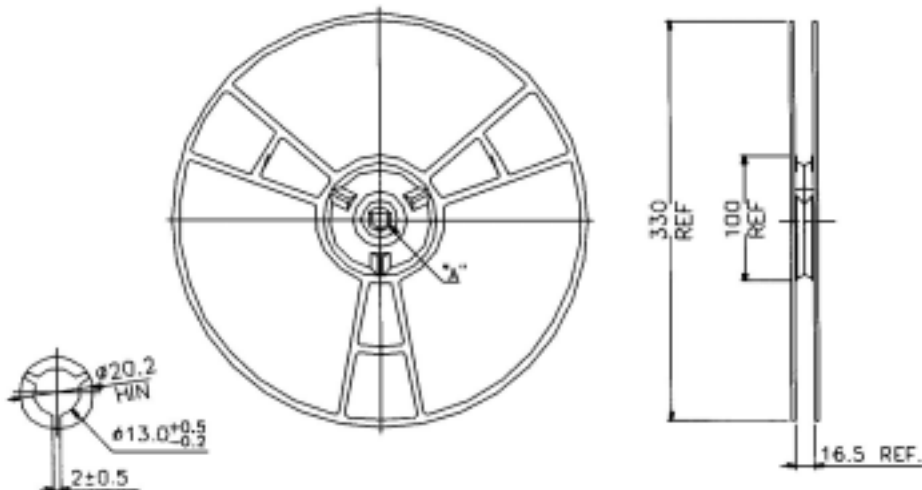
SYMBOLS	DIMENSIONS IN MILLIMETERS			DEMINSIONS IN INCHES		
	MIN	TYP	MAX	MIN	TYP	MAX
A	1.47	1.60	1.73	0.058	0.063	0.068
A1	0.10	-----	0.25	0.004	-----	0.010
A2	-----	1.45	-----	-----	0.057	-----
b	0.33	0.41	0.51	0.013	0.016	0.020
C	0.19	0.20	0.25	0.0075	0.0080	0.0098
D	9.80	9.91	10.01	0.386	0.390	0.394
E	5.79	5.99	6.20	0.228	0.236	0.244
E1	3.81	3.91	3.99	0.150	0.154	0.157
e	-----	1.27	-----	-----	0.050	-----
L	0.38	0.71	1.27	0.015	0.028	0.050
y	-----	-----	0.076	-----	-----	0.003
θ	0°	-----	8°	0°	-----	8°

NOTE:

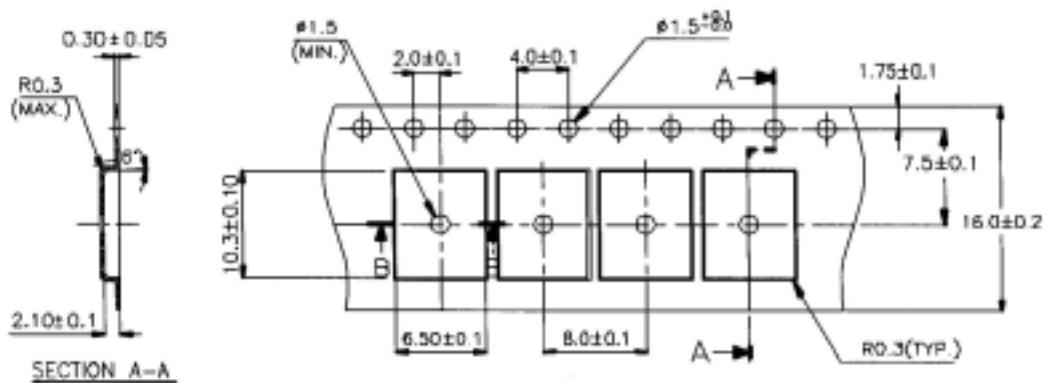
1. CONTROLLING DIMENSION: INCH
2. LEAD FRAME MATERIAL: COPPER 194
3. DIMENSION "D" DOES NOT INCLUDE MOLD FLASH, TIE BAR BURRS AND GATE BURRS. MOLD FLASH, TIE BAR BURRS AND GATE BURRS SHALL NOT EXCEED 0.006" [0.15 MILLIMETERS] PER END DIMENSION "E1" DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SAHLL NOT EXCEED 0.010" [0.25 MILLIMETERS] PER SIDE.
4. DIMENSION "b" DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.003" [0.08 MILLIMETERS] TOTAL IN EXCESS OF THE "b" DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSION AND AN ADJACENT LEAD TO BE 0.0028" [0.07 MILLIMETERS].
5. TOLERANCE: ± 0.010 " [0.25 MILLIMETERS] UNLESS OTHERWISE SPECIFIED.
6. OTHERWISE DIMENSION FOLLOW ACCEPTABLE SPEC.
7. REFERENCE DOCUMENT: JEDEC SPEC MS-012



TAPE AND REEL

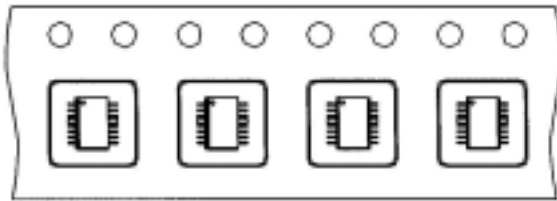


USER DIRECTION OF FEED

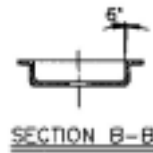




TAPE AND REEL (CONT.)



SOP 16L(150mil)



X.XXX X	± 0.0025
X.XXX	± 0.006
X.XX	± 0.025
X.X	± 0.10
X	± 0.25

UNIT: MILLIMETERS

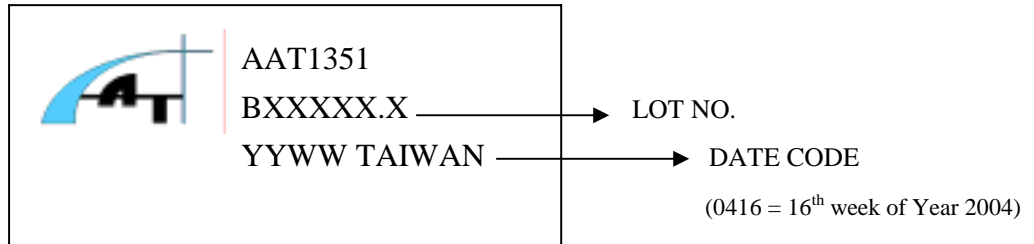
NOTE:

1. 10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE ± 0.2 .
2. CHAMBER NOT TO EXCEED 1 MILLIMETER IN 100 MILLIMETERS.
3. MATERIAL: BLACK ADVANTEK POLYSTYRENE.
4. A_0 AND B_0 MEASURED ON A PLANE 0.3 MILLIMETERS ABOVE THE BOTTOM OF THE POCKET.
5. K_0 MEASURED FROM A PLANE ON THE INSIDE BOTTOM OF THE POCKET TO THE TOP SURFACE OF THE CARRIER.
6. POCKET POSITION RELATIVE TO SPROCKET HOLE MEASURED AS TRUE POSITION OF POCKET, NOT POCKET HOLE.



PART MARKING

SOP16 TOP MARKING



NOTE: SOP16 HAS NO BACK MARKING.



ORDERING INFORMATION

AAT xxxxx-xx-x

AAT Part Number

Package Code 2
T=Taping Reel
Blank=Tube or Tray

Remark:
T=Taping Reel
PS.
Sop16→ 3,000pcs/reel

Blank=Tube

Package Code 1
Sop16: S1
Sop16 (Batwing): S6
Sop16 (Power Pad): S7