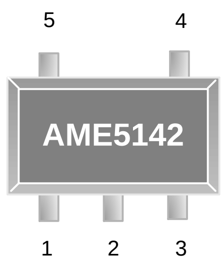
■ Pin Configuration

SOT-25/TSOT-25
Top View

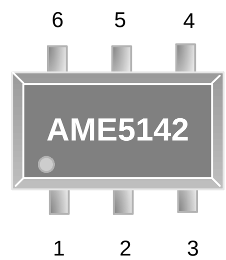


AME5142AEEV

1. SW
2. GND
3. FB
4. EN
5. IN

*** Die Attach:**
Conductive Epoxy

SOT-26/TSOT-26
Top View



AME5142AEEY

1. SW
2. GND
3. FB
4. EN
5. OVP
6. IN

*** Die Attach:**
Conductive Epoxy

■ Pin Description

AME5142AEEV

Pin Number	Pin Name	Pin Description
1	SW	Power Switch input. This is the drain of the internal NMOS power switch. Minimize the metal trace area connected to this pin to minimize EMI.
2	GND	Ground. Tie directly to ground plane.
3	FB	Output voltage feedback input. Connect the ground of the feedback network to an AGND (Analog Ground) plane which should be tied directly to the GND pin.
4	EN	Enable control input, active high. The enable pin is an active high control. Tie this pin above 1.5V to enable the device. Tie this pin below 0.4V to turn off the device.
5	IN	Analog and Power input. Input Supply Pin. Bypass this pin with a capacitor as close to the device as possible.

■ Pin Description

AME5142AEEY

Pin Number	Pin Name	Pin Description
1	SW	Power Switch input. This is the drain of the internal NMOS power switch. Minimize the metal trace area connected to this pin to minimize EMI.
2	GND	Ground. Tie directly to ground plane.
3	FB	Output voltage feedback input. Connect the ground of the feedback network to an AGND(Analog Ground) plane which should be tied directly to the GND pin.
4	EN	Enable control input, active high. The enable pin is an active high control. Tie this pin above 1.5V to enable the device. Tie this pin below 0.4V to turn off the device.
5	OVP	Over Voltage Protection.
6	IN	Analog and Power input. Input Supply Pin. Bypass this pin with a capacitor as close to the device as possible.

■ Ordering Information

AME5142 x x x x xxx x

- x — Pin Configuration
- x — Operating Ambient Temperature Range
- x — Package Type
- x — Number of Pins
- xxx — Output Voltage
- x — Special Feature

Pin Configuration		Operating Ambient Temperature Range	Package Type	Number of Pins	Output Voltage	Special Feature
A (SOT-25) (TSOT-25)	1. SW 2. GND 3. FB 4. EN 5. IN	E: -40^{O}C to 85^{O}C	E: SOT-2X	V: 5 Y: 6	ADJ: Adjustable	Y: Lead free & Low profile Z: Lead free
A (SOT-26) (TSOT-26)	1. SW 2. GND 3. FB 4. EN 5. OVP 6. IN					

■ Ordering Information

Part Number	Marking*	Output Voltage	Package	Operating Ambient Temperature Range
AME5142AEEYADJZ	BJGww	ADJ	SOT-26	-40^{O}C to 85^{O}C
AME5142AEEYADJY	BJGww	ADJ	TSOT-26	-40^{O}C to 85^{O}C
AME5142AEEVADJZ	BJHww	ADJ	SOT-25	-40^{O}C to 85^{O}C
AME5142AEEVADJY	BJHww	ADJ	TSOT-25	-40^{O}C to 85^{O}C

Note: ww represents the date code and pls refer to Date Code Rule page on Package Dimension.
* A line on top of the first letter represents lead free plating such as $\overline{\text{B}}$JGww.
Please consult AME sales office or authorized Rep./Distributor for the availability of package type.

■ Absolute Maximum Ratings

Parameter	Symbol	Maximum	Unit
Input Supply Voltage	V_{IN}	6	V
EN, FB Voltages	V_{EN},V_{FB}	V_{IN}	V
SW, OVP Voltage	V_{SW},V_{OVP}	30	V
ESD Classification	B*		

Caution: Stress above the listed in absolute maximum ratings may cause permanent damage to the device.
* HBM B: 2000V ~ 3999V

■ Recommended Operating Conditions

Parameter	Symbol	Rating	Unit
Ambient Temperature Range	T_A	-40 to 85	^oC
Junction Temperature Range	T_J	-40 to 125	
Storage Temperature Range	T_{STG}	-65 to 150	

■ Thermal Information

Parameter	Package	Die Attach	Symbol	Maximum	Unit
Thermal Resistance* (Junction to Case)	SOT-25 TSOT-25 SOT-26 TSOT-26	Conductive Epoxy	θ_{JC}	81	^oC / W
Thermal Resistance (Junction to Ambient)			θ_{JA}	260	
Internal Power Dissipation			P_D	400	mW
Solder Iron (10Sec)**				350	^oC

* Measure θ_{JC} on center of molding compound if IC has no tab.
** MIL-STD-202G 210F

■ Electrical Specifications

V_{IN} = 4.2V, EN = V_{IN}, T_A = 25^{o}C, Unless otherwise noted.

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Input Voltage	V_{IN}		2.7		5.5	V
Quiescent Current	I_Q	Switching, V_{FB} = 0V		0.85	1	mA
		Not Switching, V_{FB} = 0.2V		180	250	μA
Feedback Trip Point	V_{FB}		0.137	0.15	0.163	V
FB Pin Bias Current	I_{FB}	V_{FB} = 0.2V		0.1	1	μA
Switch Current Limit	I_{CL}		650	850	1000	mA
Switch On-Resistance	R_{DSON}	I_{SW} = 100mA, V_{FB} = 0.2V		0.7	1.4	Ω
SW Leakage Current	I_{SW}	V_{SW} = 20V		1	10	μA
Swich frequency	f_{SW}	V_{FB} = 0.1V	0.9	1.2	1.5	MHz
Maximum Duty Cycle	Dmax	V_{FB} = 0V	88	92		%
Shutdown Supply Current	I_{SD}	V_{EN} = 0V		0.01	1	μA
Over Temperature Protection	OTP	Shutdown, temperature increasing		160		^{o}C
	T_{RS}	Restore, temperature decreasing		140		
Over Voltage Protection	OVP	Rising edge	24	26	28	V
Input Undervoltage Lockout	UVP	V_{IN} rising or falling	2.35	2.5	2.65	V
EN Input Low	V_{EL}				0.4	V
EN Input High	V_{EH}		1.5			
EN Input Current	I_{EN}	EN = GND or V_{IN}		0.1	2	μA

■ Detailed Description

The AME5142 is a constant frequency step-up converter with an internal switch. The operations of AME5142 can be understood from block diagram clearly figure.2. The oscillator triggers the SET input of SR latch to turn on the power switch MS at the start of each cycle. A current sense voltage sum with a stabilizing ramp is connected to the positive terminal of the PWM comparator. When this voltage exceeds the output voltage of the error amplifier, the SR latch is reset to turn off the power switch till next cycle starts. The output voltage of the error amplifier is amplified from the difference between the reference voltage 0.15V and the feedback voltage. In this manner, if the error amplifiers voltage increases, more current is delivered to the output; if it decreases, less current is delivered. A 26V Zener diode connects from OVP pin to FB pin internally to provide an optional protection function which prevents SW pin from over-voltage damage. Especially when the case of the feedback loop broken due to component wear-out or improper connection occurs. The behavior of OVP is to clamp the output voltage to 26V typically. This function is suitable for the applications while driving white LEDs less than 6 in series.

Current Limit Protection

The AME5142 has current limiting protection to prevent excessive stress on itself and external components during overload conditions. The internal current limit comparator will disable the NMOS power device at a typical switch peak current limit of 850mA.

Output Over-Voltage Protection

The AME5142 contains dedicated circuitry for monitoring the output voltage. In the event that the primary LED network is disconnected the output will increase and be limited to 26V (TYP), which will turn the NMOS off when the output voltage is at 26V (max.) until the output voltage reach 26V (TYP.) or lower. The 26V limit allows the use of 26V 1µF ceramic output capacitors creating an overall small solution for white LED applications.

Under Voltage Protection

The AME5142 has an UVP comparator to turn the NMOS power device off in case the input voltage or battery voltage is too low preventing an on state of the power device conducting large amounts of current.

■ Application Hints

Inductor Selection

The recommended value of inductor for AME5142 applications is 10µH. Small size and better efficiency are the major concerns for portable device, such as AME5142 used for dual panel mobile phone. The inductor should have low DCR for better efficiency. To avoid inductor saturation, current rating should be at least 1A. The input range is 2.7V to 5.5V.

Capacitor Selection

4.7µF input capacitor can reduce input ripple. For better voltage stability, to increase the input capacitor value or using LC filter is feasible, especially in the Li-ion battery application. 1µF output capacitor is sufficient to reduce output voltage ripple. For better voltage filtering, ceramic capacitors with low ESR are recommended. X5R and X7R types are suitable because of their wider voltage and temperature ranges.

Diode Selection

Schottky diode is a good choice for AME5142 because of its lower forward voltage drop and faster reverse recovery. Using schottky diode can get better efficiency. The high speed rectification is also a good characteristic of schottky diode for high switching frequency. Current rating of the diode must meet the root mean square of the peak current and output average current multiplication.

Duty Cycle

The maximum duty cycle of the switching regulator determines the maximum boost ratio of output-to-input voltage that the converter can attain in mode of operation. The duty cycle for a given boost application is defined as: This applies for continuous mode operation.

$$D = \frac{V_{OUT} + V_{DIODE} - V_{IN}}{V_{OUT} + V_{DIODE} - V_{SW}}$$

■ Application Hints

Calculating Load Current

The load current is related to the average inductor current by the relation:

$I_{LOAD} = I_{IND}(AVG) \times (1 - D)$

Where "D" is the duty cycle of the application. The switch current can be found by:

$I_{SW} = I_{IND}(AVG) + 1/2 (I_{RIPPLE})$

Inductor ripple current is dependent on inductance, duty cycle, input voltage and frequency:

$I_{RIPPLE} = D \times (V_{IN}-V_{SW}) / (f \times L)$

Combining all terms, we can develop an expression which allows the maximum available load current to be calculated:

$$I_{LOAD} = (1-D) \times \left(I_{SW}(max) - \frac{D(V_{IN}-V_{SW})}{2fL} \right)$$

Thermal Considerations

At higher duty cycles, the increased ON time of the FET means the maximum output current will be determined by power dissipation within the AME5142 switch. The switch power dissipation from ON-state conduction is calculated by:

$P_{(SW)} = D \times I_{IND(AVE)2} \times R_{DS}(ON)$

There will be some switching losses as well, so some derating needs to be applied when calculating IC power dissipation.

Shutdown Pin Operation

The device is turned off by pulling the shutdown pin low. If this function is not going to be used, the pin should be tied directly to V_{IN}. If the SHDN function will be needed, a pull-up resistor must be used to V_{IN} (approximately 50k-100k recommended). The EN pin must not be left unterminated.

Dimming Control

A. Using a PWM Signal to EN Pin

For controlling the LED brightness, the AME5142 can perform the dimming control by applying a PWM signal to EN pin.

The average LED current is proportional to the PWM signal duty cycle. The magnitude of the PWM signal should be higher than the maximum enable voltage of EN pin, in order to let the dimming control perform correctly.

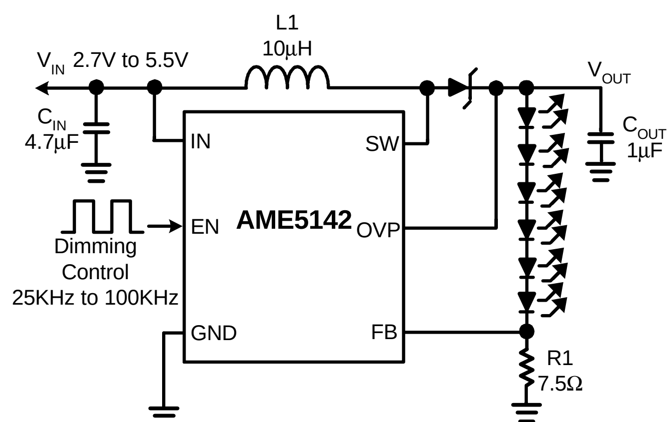


Figure 5. PWM Dimming Control Using the EN Pin

■ Application Hints

Dimming Control

B. Using a DC Voltage

Using a variable DC voltage to adjust the brightness is a popular method in some applications. The dimming control using a DC voltage circuit is shown in Figure 6. According to the Superposition Theorem, as the DC voltage increases, the voltage contributed to V_{FB} increases and the voltage drop on R2 decreases, i.e. the LED current decreases. For example, if the V_{DC} range is from 0V to 3V, the selection of resistors in Figure 6 sets dimming control of LED current from 20mA to 0mA.

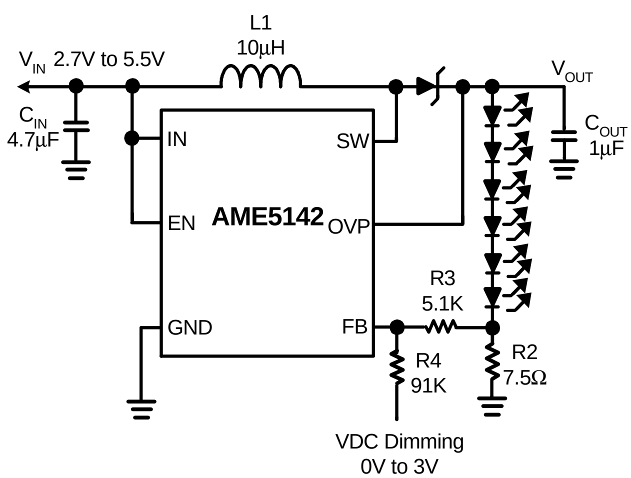


Figure6. Dimming Control Using a DC Voltage

C. Using a Filtered PWM Signal

The filtered PWM signal can be considered as an adjustable DC voltage. It can be used to replace the variable DC voltage source in dimming control. The circuit is shown in Figure 7.

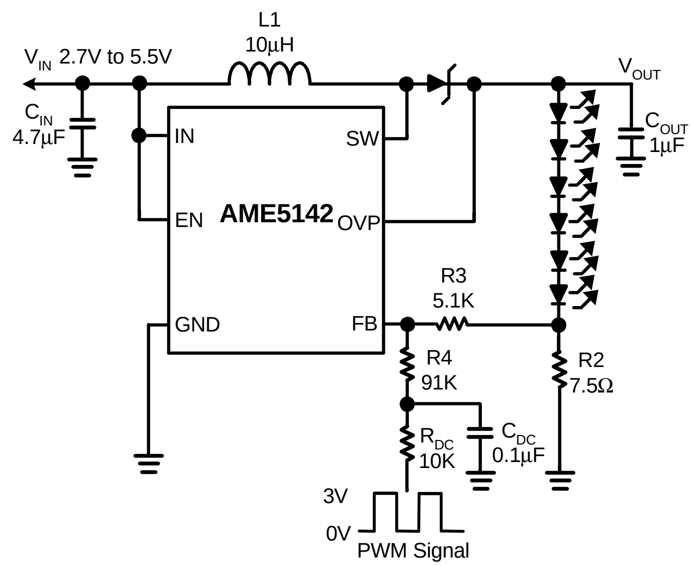
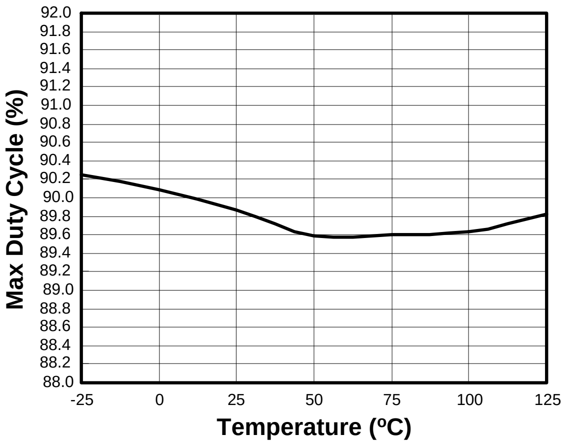
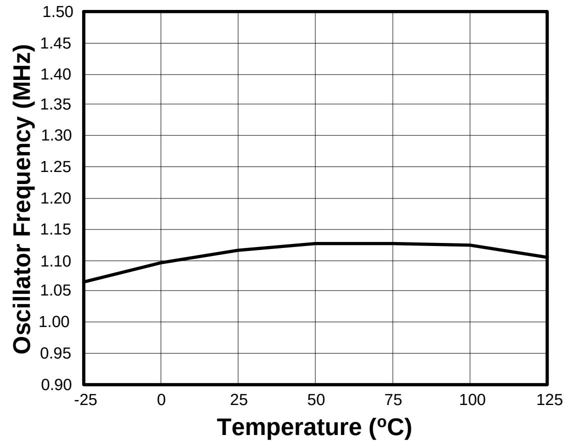


Figure 7. Dimming Control Using a Filtered PWM Signal

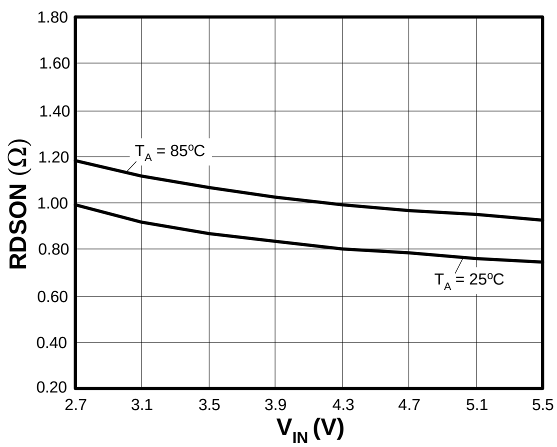
Max Duty Cycle vs. Temperature



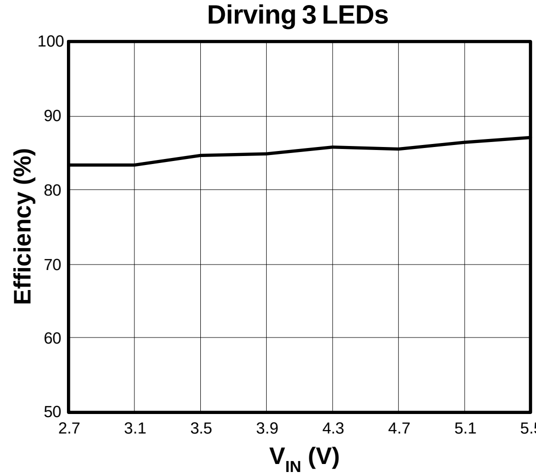
Oscillator Frequency vs. Temperature



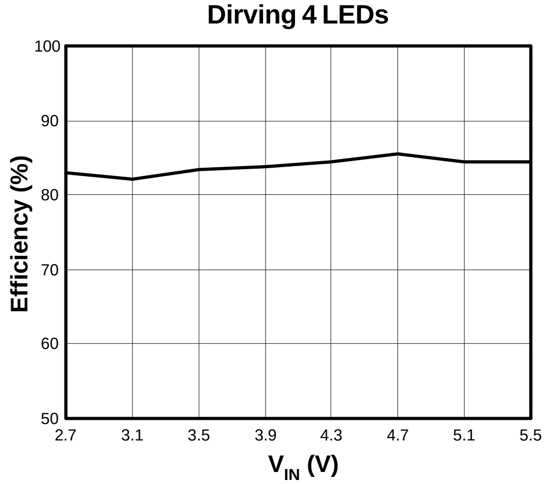
Switch RDSON



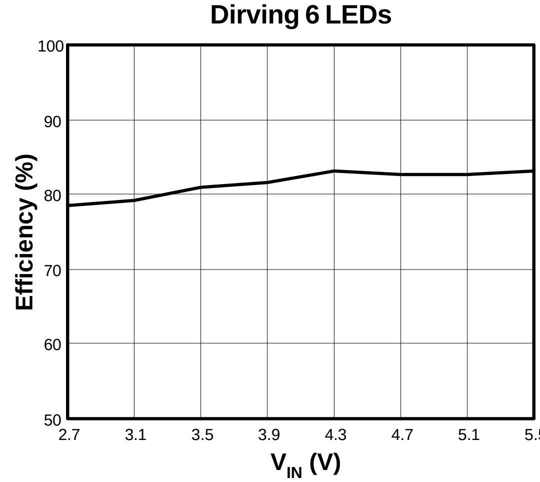
Efficiency vs. Load Current Dirving 3 LEDs



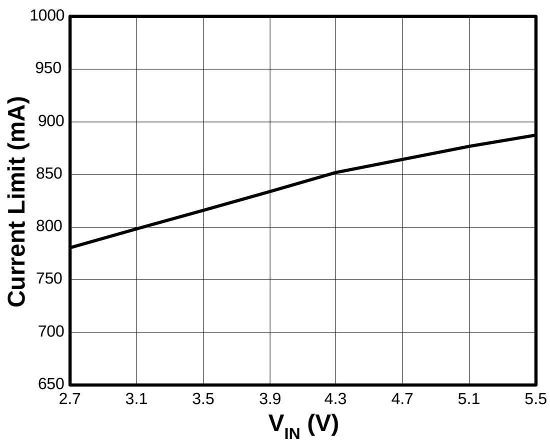
Efficiency vs. Load Current Dirving 4 LEDs



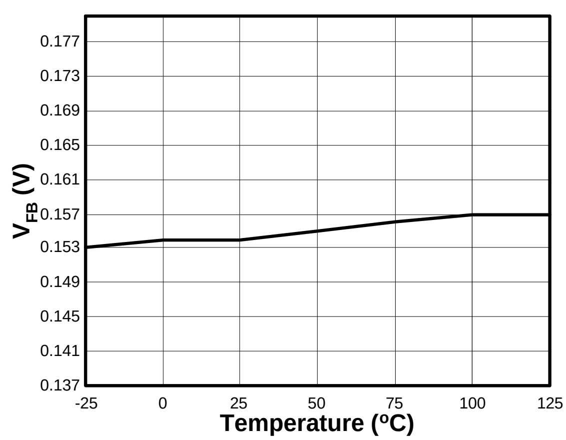
Efficiency vs. Load Current Dirving 6 LEDs



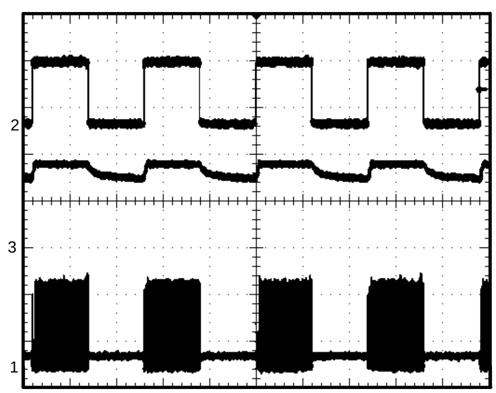
Current Limit vs. V_{IN}



V_{FB} vs. Temperature



Dimming Control for Driving 6LEDs

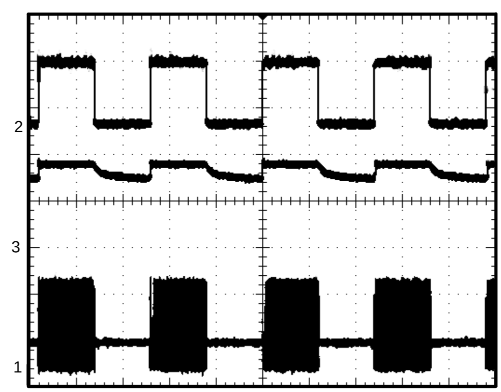


1mS / div

V_{IN} = 2.7V; 6 LEDs
I_{OUT} = 20mA

2) EN = 1V / div, DC f = 200Hz
3) V_{OUT} , 10V / div, DC
1) V_{SW}= 10V / div, DC

Dimming Control for Driving 6LEDs

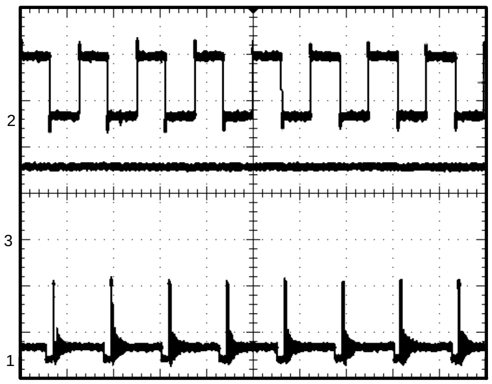


1mS / div

V_{IN} = 5.5V; 6 LEDs
I_{OUT} = 20mA

2) EN = 1V / div, DC f = 200Hz
3) V_{OUT} , 10V / div, DC
1) V_{SW}= 10V / div, DC

Dimming Control for Driving 6LEDs

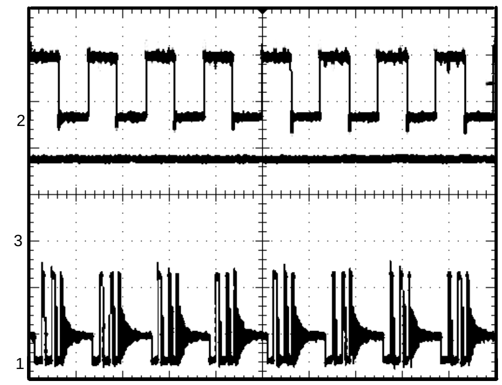


4mS / div

V_{IN} = 2.7V; 6 LEDs
I_{OUT} = 20mA

2) EN = 1V / div, DC f = 200KHz
3) V_{OUT} , 10V / div, DC
1) V_{SW} = 10V / div, DC

Dimming Control for Driving 6LEDs

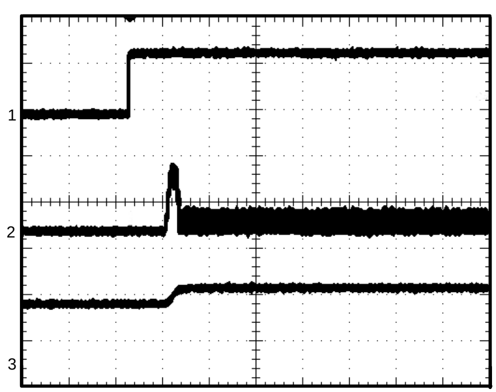


4mS / div

V_{IN} = 5.5V; 6 LEDs
I_{OUT} = 20mA

2) EN = 1V / div, DC f = 200KHz
3) V_{OUT} , 10V / div, DC
1) V_{SW} = 10V / div, DC

Start-Up / Shutdown

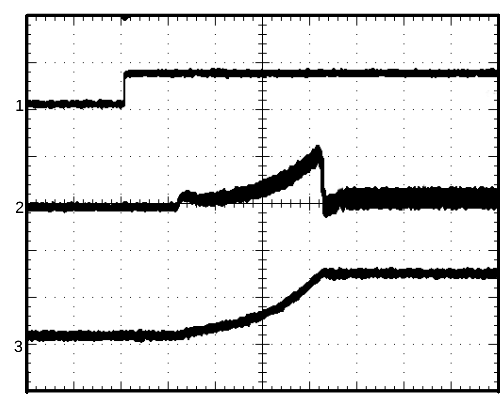


200mS / Div

V_{IN} = 2.7V; 1 LEDs
I_{OUT} = 20mA

1) EN = 2V/div, DC
2) Inductor Current, 100mA / div, DC
3) V_{OUT} , 2V / div, DC

Start-Up / Shutdown

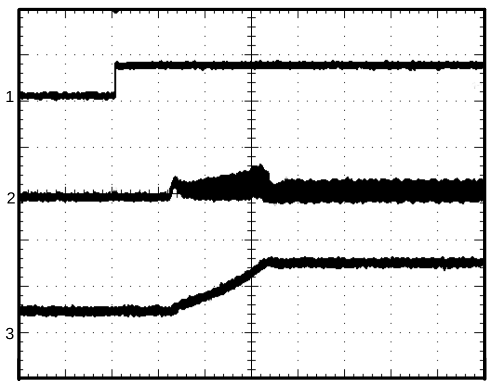


200mS / div

V_{IN} = 2.7V; 6 LEDs
I_{OUT} = 20mA

1) EN = 2V / div, DC
2) Inductor Current, 500mA / div, DC
3) V_{OUT} , 10V / div, DC

Start-Up / Shutdown

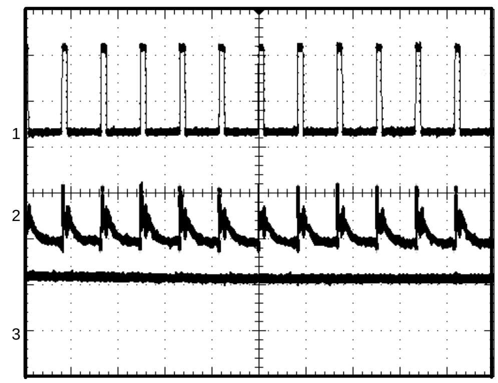


200mS / div

V_{IN} = 5.5V; 6 LEDs
I_{OUT} = 20mA

1) EN = 2V / div, DC
2) Inductor Current, 500mA / div, DC
3) V_{OUT} , 10V / div, DC

Typical Switching Waveform

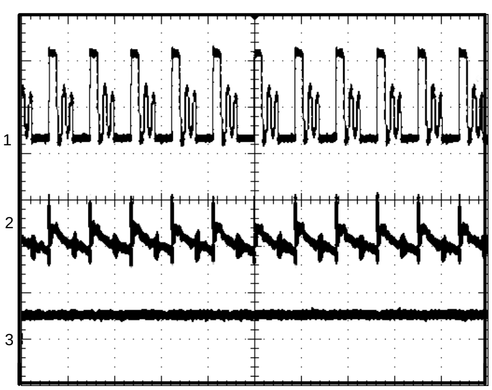


1mS / div

V_{IN} = 5.5V; 6 LEDs
I_{OUT} = 20mA

1) V_{SW} = 10V / div, DC
2) V_{OUT} , 20mV / div, AC
3) Input Current, 100mA / div, DC
Inductor = 10µH, C_{OUT} = 1µF

Typical Switching Waveform



1mS / div

V_{IN} = 2.7V; 6 LEDs
I_{OUT} = 20mA

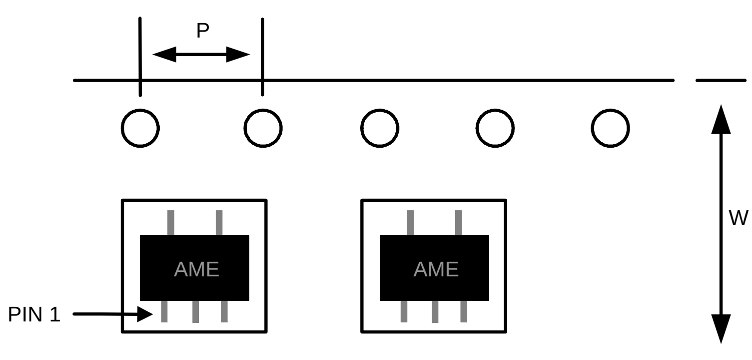
1) V_{SW} = 10V / div, DC
2) V_{OUT} , 20mV / div, AC
3) Input Current, 100mA / div, DC
Inductor = 10µH, C_{OUT} = 1µF

■ Date Code Rule

Marking			Date Code		Year
A	A	A	W	W	xxx0
A	A	A	W	$\underline{W}$	xxx1
A	A	A	$\underline{W}$	W	xxx2
A	A	A	$\underline{W}$	$\underline{W}$	xxx3
A	A	$\underline{A}$	W	W	xxx4
A	A	$\underline{A}$	W	$\underline{W}$	xxx5
A	A	$\underline{A}$	$\underline{W}$	W	xxx6
A	A	$\underline{A}$	$\underline{W}$	$\underline{W}$	xxx7
A	$\underline{A}$	A	W	W	xxx8
A	$\underline{A}$	A	W	$\underline{W}$	xxx9

■ Tape and Reel Dimension

SOT-25

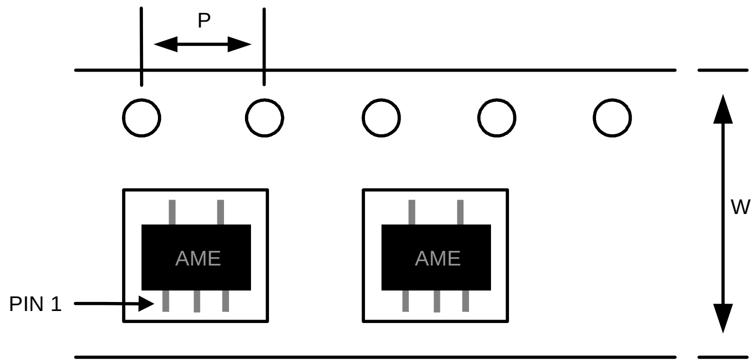


Carrier Tape, Number of Components Per Reel and Reel Size

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
SOT-25	8.0±0.1 mm	4.0±0.1 mm	3000pcs	180±1 mm

■ Tape and Reel Dimension

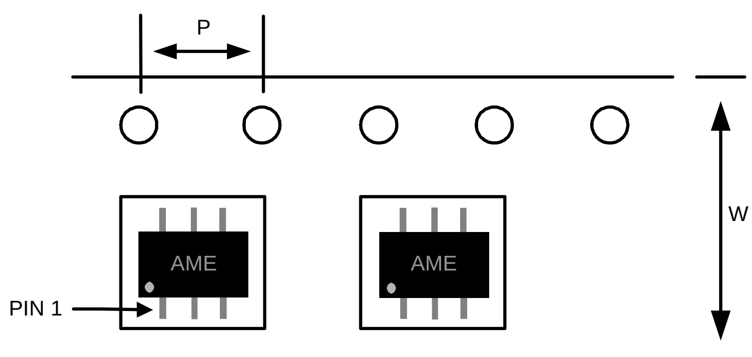
TSOT-25



Carrier Tape, Number of Components Per Reel and Reel Size

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
TSOT-25	8.0±0.1 mm	4.0±0.1 mm	3000pcs	180±1 mm

SOT-26

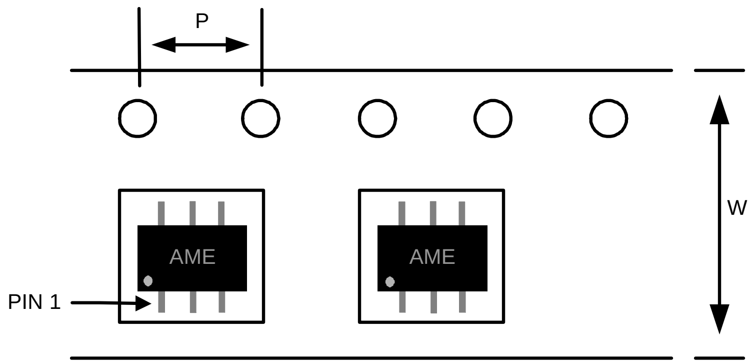


Carrier Tape, Number of Components Per Reel and Reel Size

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
SOT-26	8.0±0.1 mm	4.0±0.1 mm	3000pcs	180±1 mm

■ Tape and Reel Dimension

TSOT-26

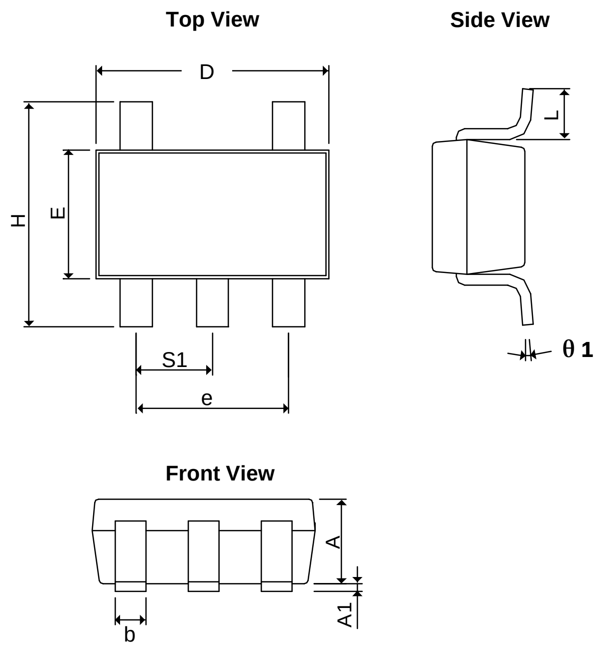


Carrier Tape, Number of Components Per Reel and Reel Size

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
TSOT-26	8.0±0.1 mm	4.0±0.1 mm	3000pcs	180±1 mm

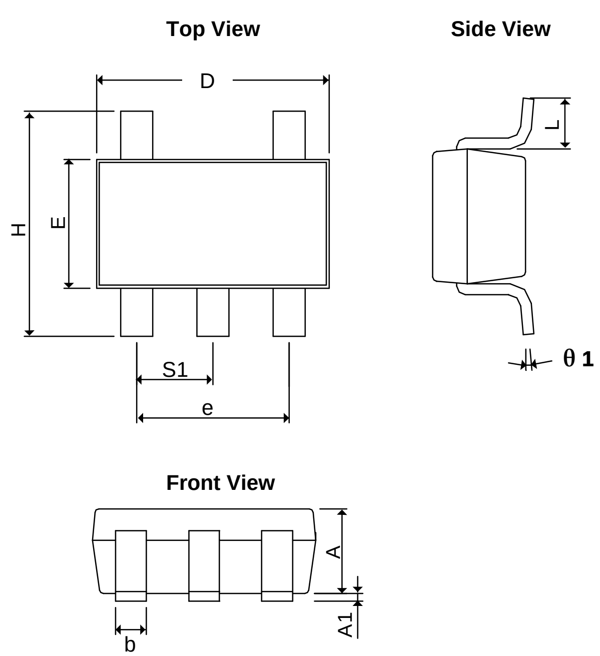
■ Package Dimension

SOT-25



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.20REF		0.0472REF	
A_1	0.00	0.15	0.0000	0.0059
b	0.30	0.55	0.0118	0.0217
D	2.70	3.10	0.1063	0.1220
E	1.40	1.80	0.0551	0.0709
e	1.90 BSC		0.07480 BSC	
H	2.60	3.00	0.10236	0.11811
L	0.37BSC		0.0146BSC	
θ1	0^o	10^o	0^o	10^o
S_1	0.95BSC		0.0374BSC	

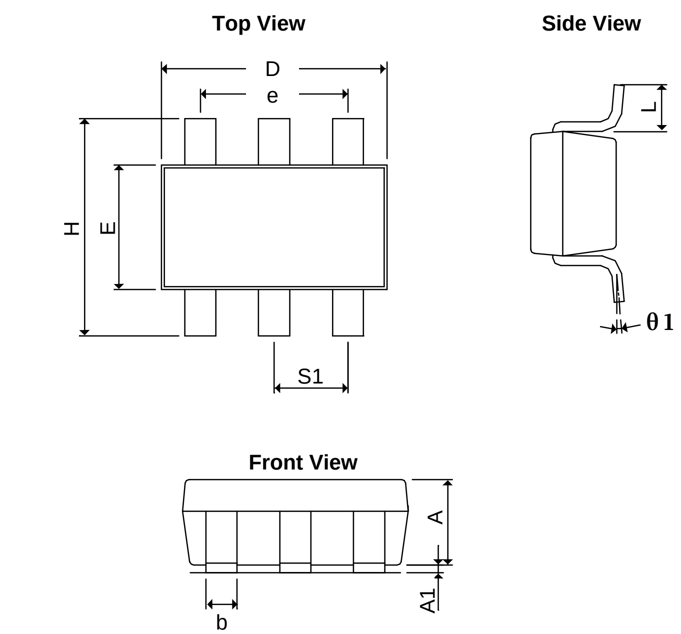
TSOT-25



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
$A+A_1$	0.90	1.25	0.0354	0.0492
b	0.30	0.50	0.0118	0.0197
c	0.09	0.25	0.0035	0.0098
D	2.70	3.10	0.1063	0.1220
E	1.40	1.80	0.0551	0.0709
e	1.90 BSC		0.07480 BSC	
H	2.40	3.00	0.09449	0.11811
L	0.35BSC		0.0138BSC	
θ1	0^o	10^o	0^o	10^o
S_1	0.95BSC		0.0374BSC	

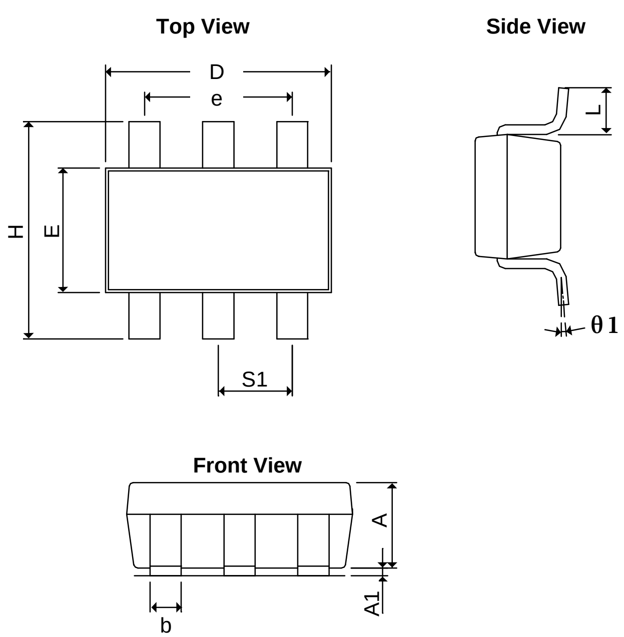
■ Package Dimension

SOT-26



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.20REF		0.0472REF	
A_1	0.00	0.15	0.0000	0.0059
b	0.30	0.55	0.0118	0.0217
D	2.70	3.10	0.1063	0.1220
E	1.40	1.80	0.0551	0.0709
e	1.90 BSC		0.0748 BSC	
H	2.60	3.00	0.10236	0.11811
L	0.37REF		0.0146REF	
q1	0^{o}	10^{o}	0^{o}	10^{o}
S_1	0.95REF		0.0374REF	

TSOT-26



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
$A+A_1$	0.90	1.25	0.0354	0.0492
b	0.30	0.50	0.0118	0.0197
D	2.70	3.10	0.1063	0.1220
E	1.40	1.80	0.0551	0.0709
e	1.90 BSC		0.07480 BSC	
H	2.40	3.00	0.09449	0.11811
L	0.35BSC		0.0138BSC	
q1	0^{o}	10^{o}	0^{o}	10^{o}
S_1	0.95BSC		0.0374BSC	

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