DC-to-DC Converter Control Circuit

LM34063AQ8

Description

The LM34063AQ8 is a monolithic control circuit containing the primary functions required for DC-to-DC converters. This device consists of an internal temperature compensated reference, comparator, control- led duty cycle oscillator with an active current limit circuit, driver and high current output switch.

Features

- 3V to 40V Input Voltage Operation
- Internal 1.6A Peak Current Switch
- Internal ±1.8% Reference
- Low Quiescent Current at 1.6mA
- Frequency Operation from 100Hz~100KHz
- Current Limiting

Applications

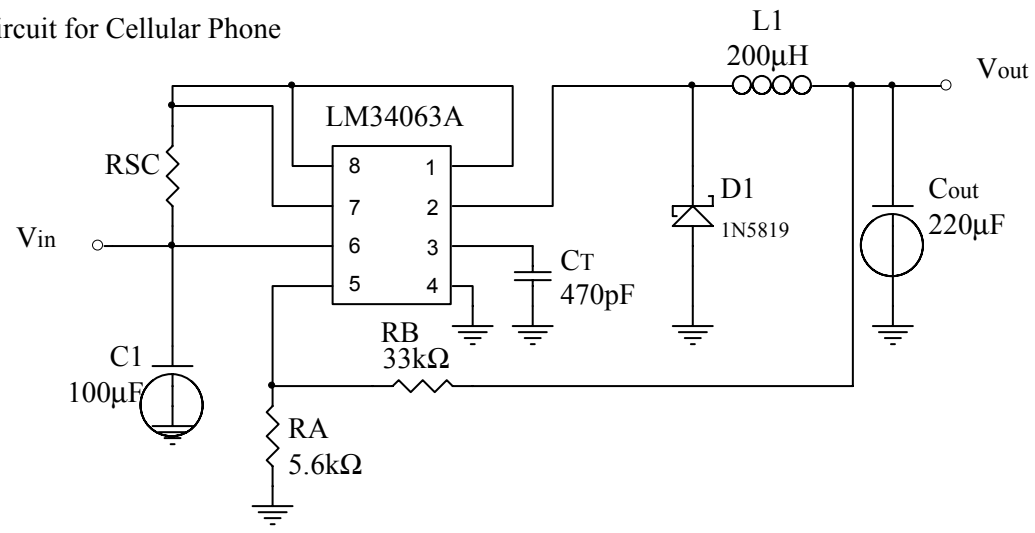
- Saver for Cellular Phone
- DC-DC Converter Module

Ordering Information

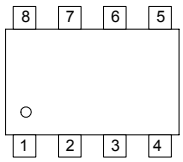
Device	Package	Shipping
LM34063AQ8	SOP-8 (Pb-free lead plating package)	2500 pcs / tape & reel, 3000 pcs/tape & reel

Typical Application Circuit

Fig1.Saver Circuit for Cellular Phone



Pin Connections



Pin1:Switch Collector	Pin5:Comparator Inverting Input
Pin2:Switch Emitter	Pin6:Vcc
Pin3:Timing Capacitor	Pin7:Ipk Sense
Pin4:Gnd	Pin8:Driver Collector

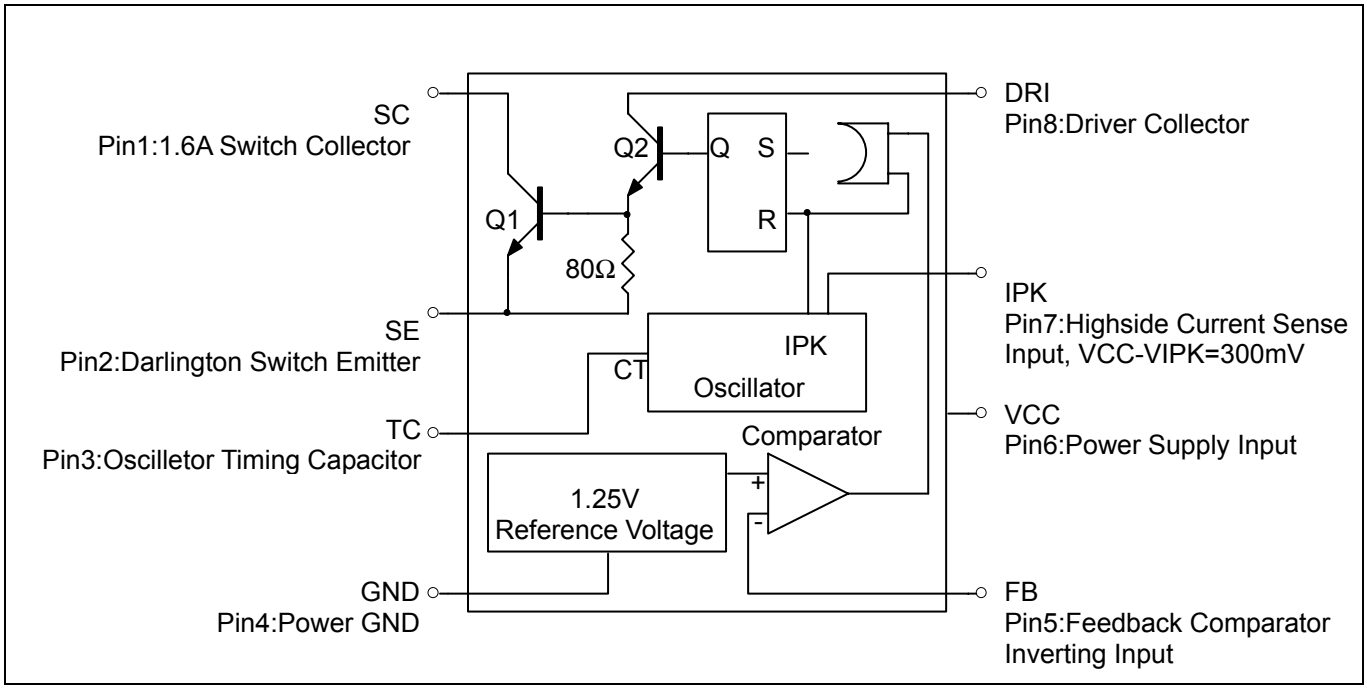
Absolute Maximum Rating

Supply Voltage ..... 40 V
Comparator Input Voltage Range ..... -0.3 V ~ 40 V
Switch Collector Voltage ..... 40 V
Switch Emitter Voltage ..... 40 V
Switch Collector to Emitter Voltage ..... 40 V
Driver Collector Voltage ..... 40 V
Switch Current 1.6A
Power Dissipation @ Ta=25°C ..... 625 mW
Thermal Resistance Junction to Air ..... 160 °C / W
Operating Junction Temperature ..... 125 °C
Operating Ambient Temperature Range ..... 0 ~ 70 °C
Storage Temperature Range ..... -40 °C ~ 125 °C

Electrical Characteristics (Vcc=5V,Ta=25°C, unless otherwise specified)

Parameter	Test Condition	Symbol	Min.	Typ.	Max.	Unit
Oscillator						
Frequency	Vpin 5=0V, C_T=1nF	f_{OSC}	30	38	45	kHz
Charging Current	5.0V≤V_{CC}≤40V	I_{chg}	30	38	45	μA
Discharge Current	5.0V≤V_{CC}≤40V	I_{dischg}	180	240	290	μA
Voltage Amplitude	Pin3	V_{OSC}	-	0.6	-	V
Discharge to Charge Current Ratio	$V_{IPK(Sense)}$ =V_{CC}	I_{Dischg}/I_{chg}	5.2	6.5	7.5	-
Current Limit Sense Voltage	I_{Chg}=I_{dischg}	$V_{IPK(Sence)}$	250	300	350	mV
Output Switch						
Saturation Voltage, Darlington Connection	I_{SW}=1.0A, $V_{C(Driver)}$=VC(Switch)	$V_{CE(Sat)}$	-	1.0	1.3	V
Saturation Voltage	I_{SW}=1.0A, $I_{C(Driver)}$=50mA (Forced β ≈ 20)	$V_{CE(Sat)}$	-	0.45	0.8	V
DC Current Gain	I_{SW}=1.0A, V_{CE}=5.0V	hFE	50	75	-	-
Collector Off-State Current	V_{CE}=40V	$I_{CC(Off)}$	-	0.01	100	μA
Comparator						
Threshold Voltage	 0°C≤Ta≤70°C	V_{TH}	1.225 1.210	1.250 -	1.275 1.290	V
Threshold Voltage Line Regulation	3.0V≤V_{CC}≤40V	Regline	-	1.4	5	mV
Input Bias Current	V_{IN}=0V	I_{IB}	-	-20	-400	nA
Supply Current	$V_{IPK(Sence)}$=V_{CC} V_{Pin5}>V_{FB}, 5.0V≤V_{CC}≤40V C_T=1nF, Pin2=Gnd Remaining pins open	I_{CC}	-	1.6	4	mA

Block Diagram



Application Information

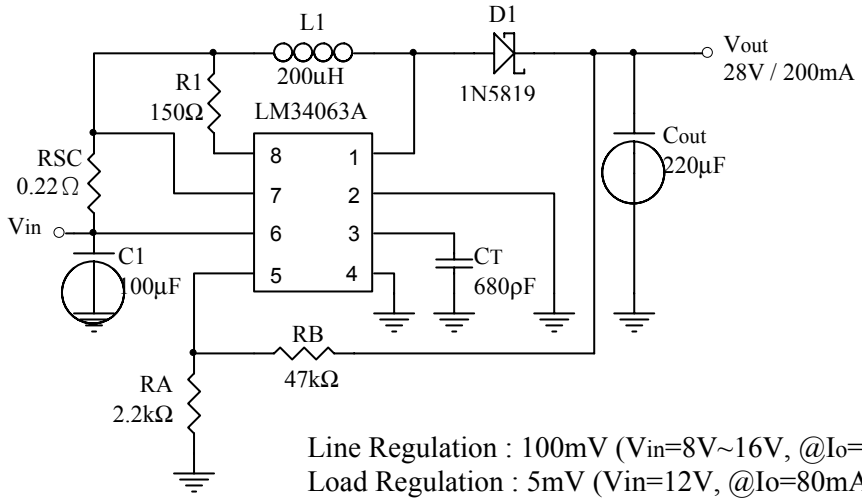
Design Formula Table

Calculation	Step-Down	Step-Up	Voltage-Inverting
t_{on} / t_{off}	$V_{out}+V_F$ / $V_{in(min)}-V_{sat}-V_{Out}$	$V_{out}+V_F-V_{in(min)}$ / $V_{in(min)}-V_{sat}$	$\|V_{out}\|+V_F$ / $V_{in}-V_{sat}$
($t_{on}+t_{off}$) max	$1/F_{min}$	$1/F_{min}$	$1/F_{min}$
C_T	$4*10^{-5}t_{on}$	$4*10^{-5}t_{on}$	$4*10^{-5}t_{on}$
$I_{C(switch)}$	$2*I_{out(max)}$	$2*I_{out(max)}(t_{on}+t_{off}/t_{off})$	$2*I_{out(max)}(t_{on}+t_{off}/t_{off})$
RS	$0.3 / I_{C(switch)}$	$0.3 / I_{C(switch)}$	$0.3 / I_{C(switch)}$
$L_{(min)}$	$(V_{in(min)}-V_{sat}-V_{out} / I_{C(switch)})$ $*t_{on(max)}$	$(V_{in(min)}-V_{sat} / I_{C(switch)})$ $*t_{on(max)}$	$(V_{in(min)}-V_{sat} / I_{C(switch)})$ $*t_{on(max)}$
C_O	$I_{C(switch)}*(t_{on}+t_{off})$ / $8V_{Ripple(P-P)}$	$I_{out}*t_{on} / V_{Ripple(P-P)}$	$I_{out}*t_{on} / V_{Ripple(P-P)}$

V_{sat} : Saturation voltage of the output switch.
V_F : Forward voltage drop of the ringback rectifier.
The following power supply characteristics must be chosen :
V_{in} : Nominal input voltage.
V_{out} : Desired output voltage. $|V_{out}|=1.25*(1+RB/RA)$
I_{out} - Desired output current
Fmin : Minimum desired output switching frequency at the selected values for V_{in} and I_{out}.
$V_{Ripple(P-P)}$: Desired peak to peak output ripple voltage in practice, the calculated value will need to be increased due to the capacitor equivalent series resistance and board layout. The ripple voltage should be kept to a low value since it will directly effect the line and load regulation.

Application Information (Continued)

Fig.2 Step-Up Converter



Line Regulation : 100mV (Vin=8V~16V, @Io=200mA)
Load Regulation : 5mV (Vin=12V, @Io=80mA~200mA)

Fig.3 Step-Up Converter With External NPN Switch

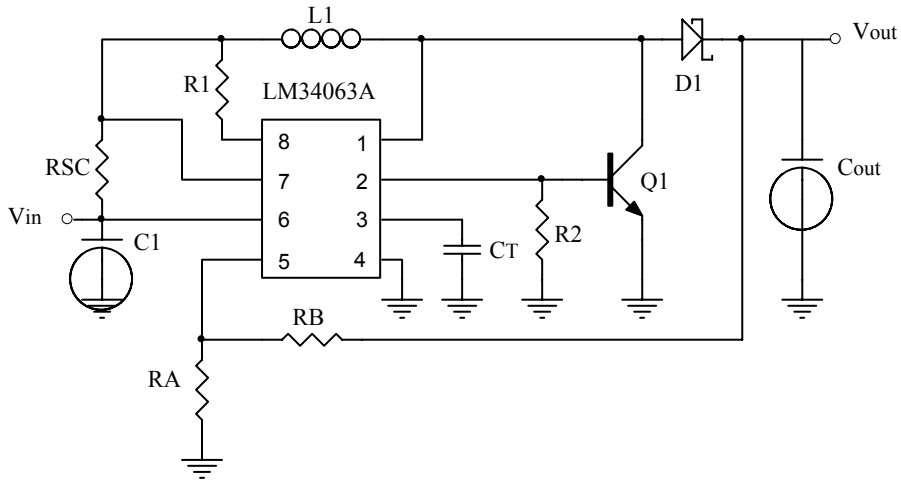
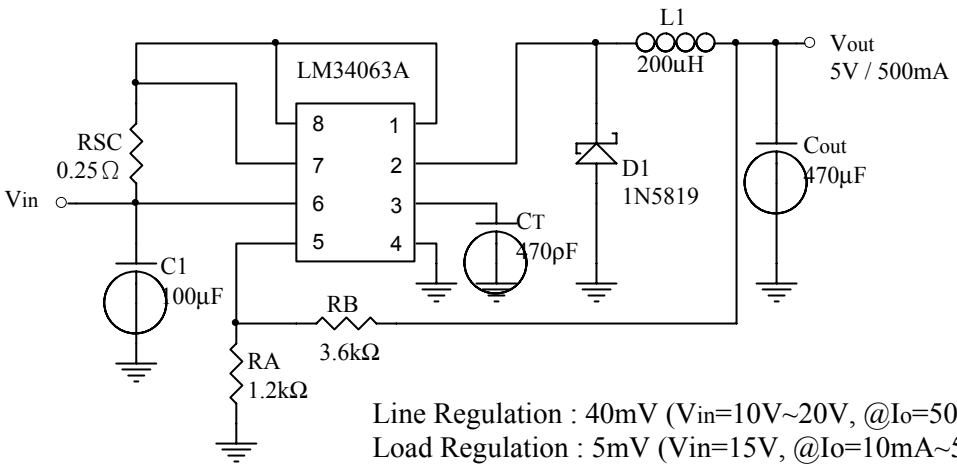


Fig.4 Step-Down Converter



Line Regulation : 40mV (Vin=10V~20V, @Io=500mA)
Load Regulation : 5mV (Vin=15V, @Io=10mA~500mA)
Short Circuit Current : 1.3A (Vin=15V, @RL=0.1Ω)

Application Information (Continued)

Fig.5 Step-Down Converter With External PNP Saturation Switch

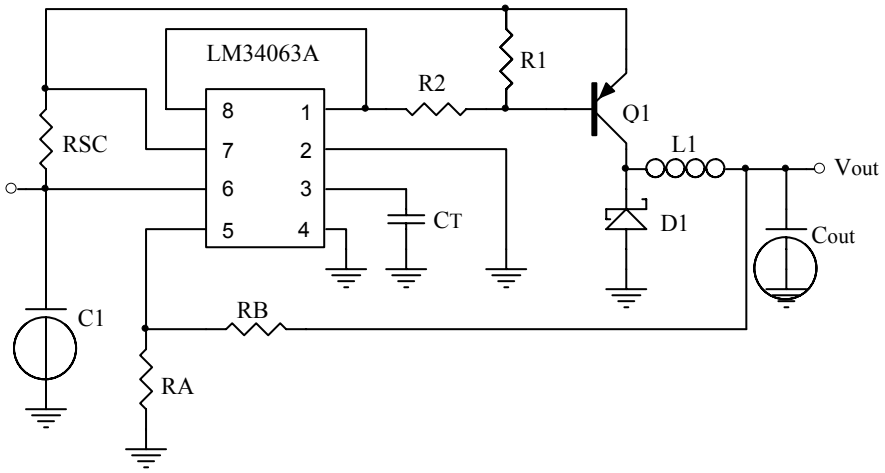
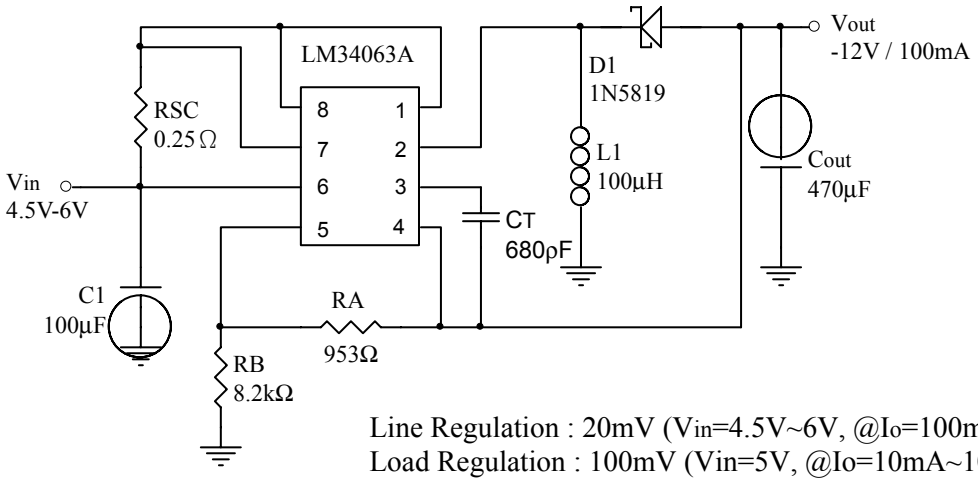
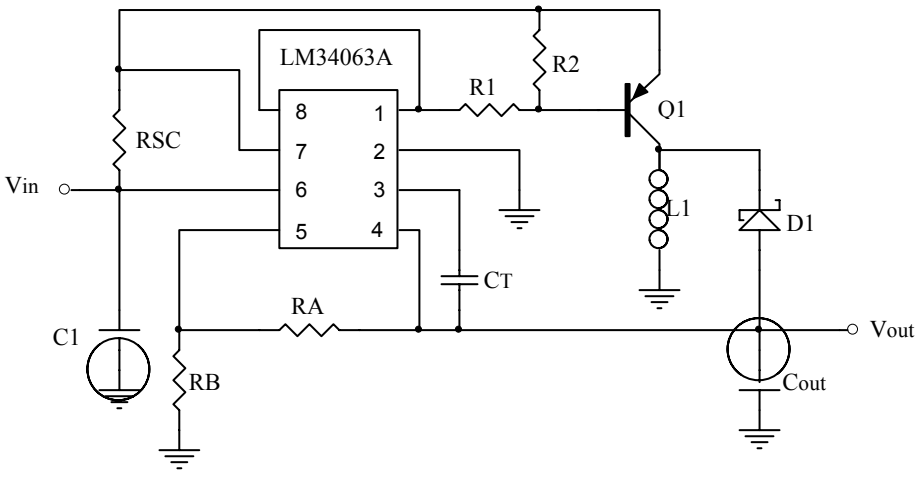


Fig.6 Voltage Inverting Converter



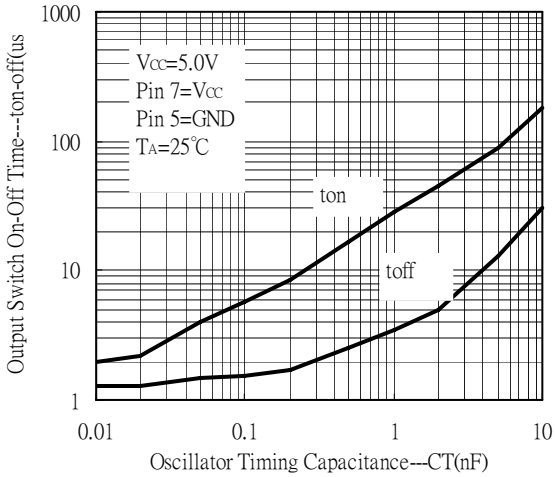
Line Regulation : 20mV (V_{in}=4.5V~6V, @I_o=100mA)
Load Regulation : 100mV (Vin=5V, @Io=10mA~100mA)

Fig.7 Voltage Inverting Converter With External PNP Saturation Switch

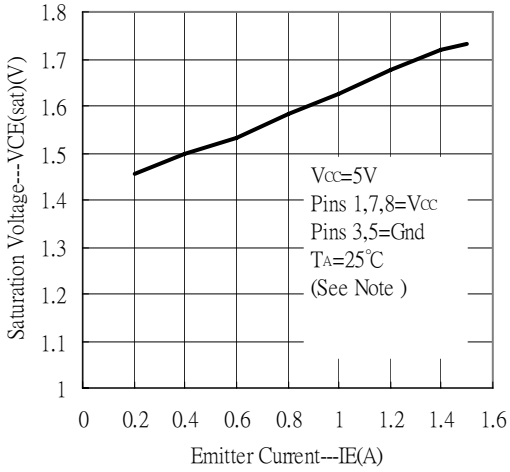


Characteristic Curves

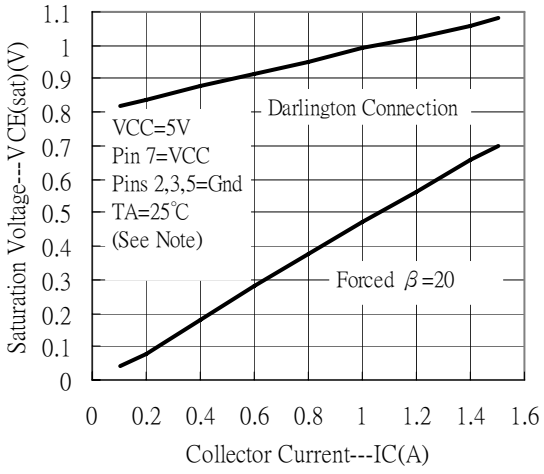
Output Switch On-Off Time vs Oscillator Timing Capacitance



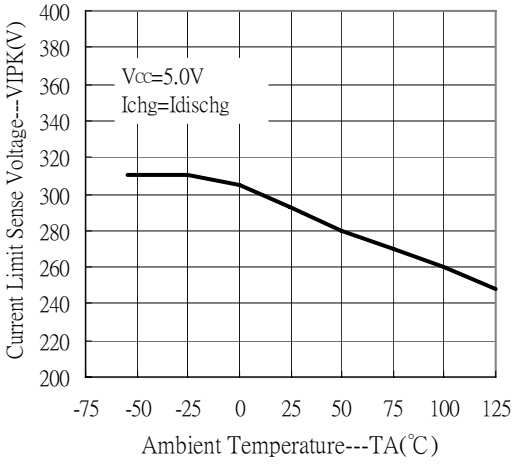
Emitter Follower Configuration Output Saturation Voltage vs Emitter Current



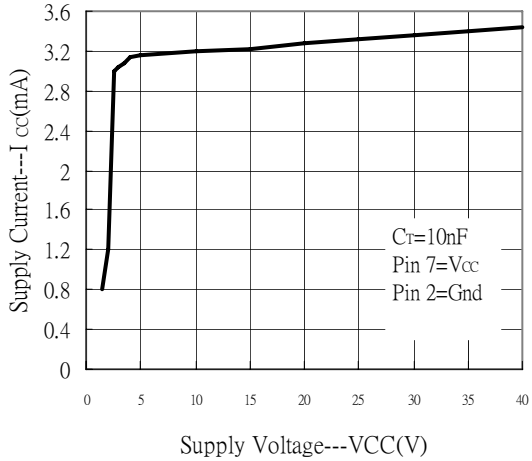
Common Emitter Configuration Output Switch Saturation Voltage vs Collector Current



Current Limit Sense Voltage vs Temperature

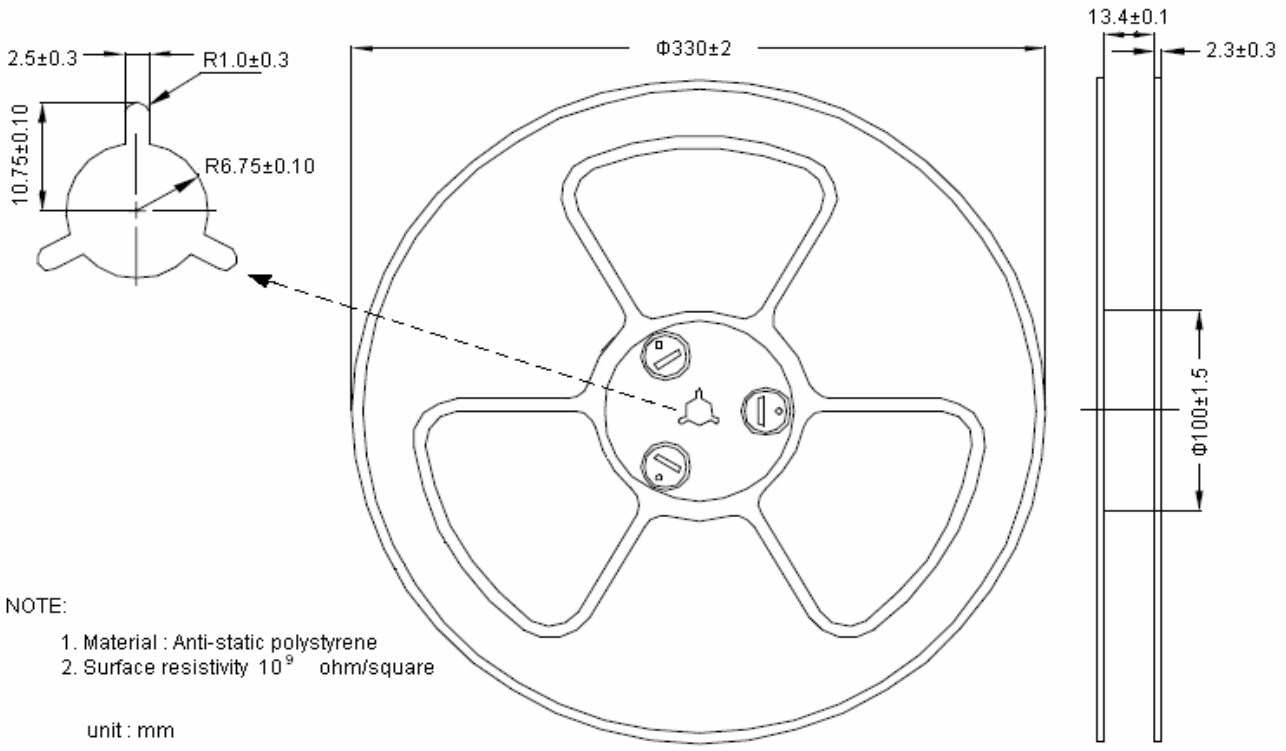


Standby Supply Current vs Supply Voltage



Note: Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient temperature as possible.

Reel Dimension

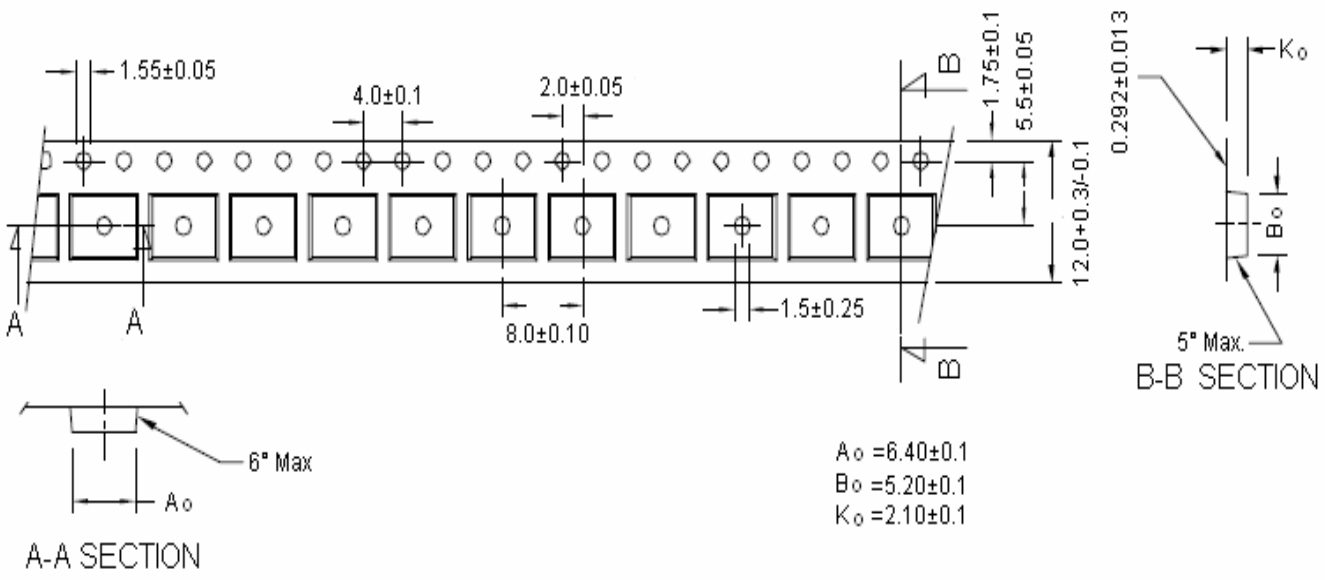


NOTE:

1. Material : Anti-static polystyrene
2. Surface resistivity 10^9 ohm/square

unit : mm

Carrier Tape Dimension



Notes:

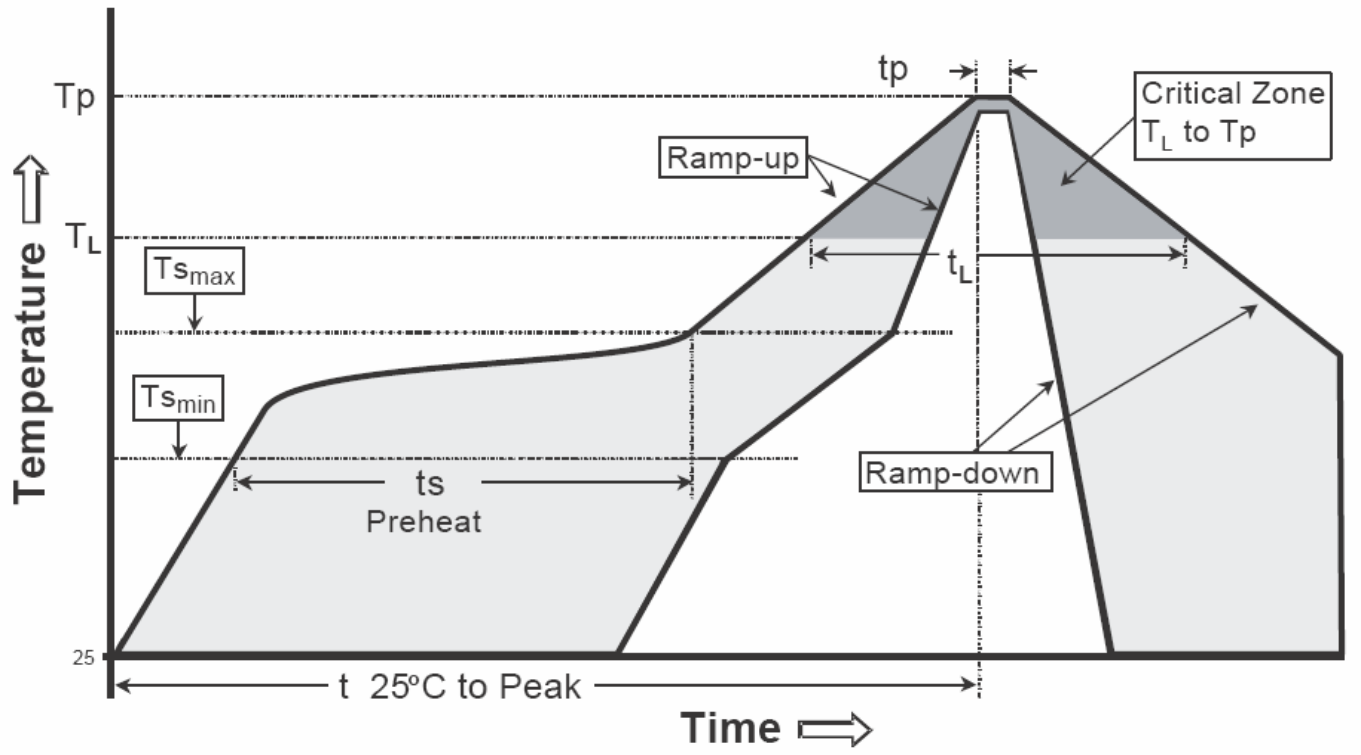
1. 10 sprocket hole pitch cumulative tolerance ±0.2.
2. Camber not to exceed 1mm in 100mm.
3. Material: conductive black polystyrene
4. Ao & Bo measured on a plane 0.3mm above the bottom of the pocket.
5. Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
6. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.

Uni : millimeter

Recommended wave soldering condition

Product	Peak Temperature	Soldering Time
Pb-free devices	260 +0/-5 °C	5 +1/-1 seconds

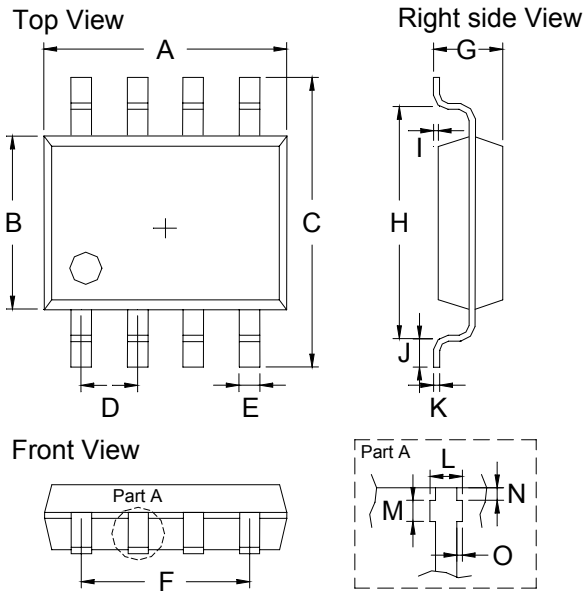
Recommended temperature profile for IR reflow

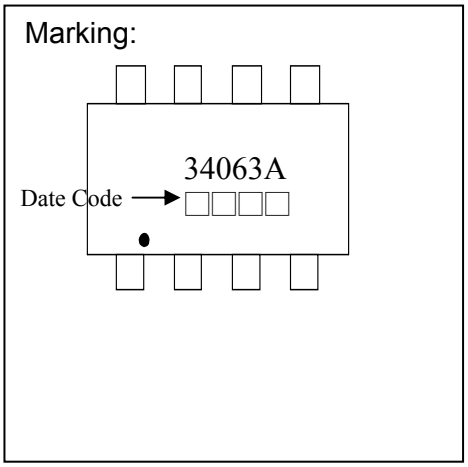


Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (Tsmax to Tp)	3°C/second max.	3°C/second max.
Preheat −Temperature Min(T_S min) −Temperature Max(T_S max) −Time($t_{s\ min}$ to $t_{s\ max}$)	 100°C 150°C 60-120 seconds	 150°C 200°C 60-180 seconds
Time maintained above: −Temperature (T_L) − Time (t_L)	 183°C 60-150 seconds	 217°C 60-150 seconds
Peak Temperature(T_P)	240 +0/-5 °C	260 +0/-5 °C
Time within 5°C of actual peak temperature(tp)	10-30 seconds	20-40 seconds
Ramp down rate	6°C/second max.	6°C/second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

Note : All temperatures refer to topside of the package, measured on the package body surface.

SO-8 Dimension





8-Lead SO-8 Plastic Package
CYStek Package Code: Q8

*: Typical

DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.1909	0.2007	4.85	5.10	I	0.0019	0.0078	0.05	0.20
B	0.1515	0.1555	3.85	3.95	J	0.0118	0.0275	0.30	0.70
C	0.2283	0.2441	5.80	6.20	K	0.0074	0.0098	0.19	0.25
D	0.0480	0.0519	1.22	1.32	L	0.0145	0.0204	0.37	0.52
E	0.0145	0.0185	0.37	0.47	M	0.0118	0.0197	0.30	0.50
F	0.1472	0.1527	3.74	3.88	N	0.0031	0.0051	0.08	0.13
G	0.0570	0.0649	1.45	1.65	O	0.0000	0.0059	0.00	0.15
H	0.1889	0.2007	4.80	5.10					

Notes: 1.Controlling dimension: millimeters.
2.Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.
3.If there is any question with packing specification or packing method, please contact your local CYStek sales office.

Material:

- Lead: Pure tin plated.
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0.

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