AP1604

PWM/PFM Dual Mode Step-down DC/DC Converter

■ Features

- Input voltage range:2.2V~6V（V_{OUT} type）
- Oscillator frequency: 600kHz（Typ.）
- High Efficiency: 93%（typ .）
- Stand-by capability: I_{STB}=5μA.（max.）
- Soft-start time set-up externally type possible
- Current limit and thermal shutdown protection
- **Pb-Free** Package: SOT23-5

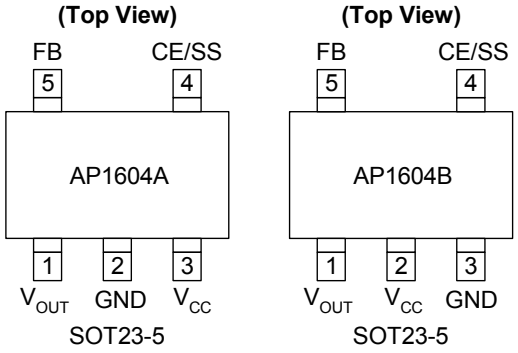
■ Applications

- Electronic Information Organizers
- Palmtops
- Cellular and portable phones
- Portable Audio Systems
- Various Multi-function Power Supplies

■ General Descriptions

The AP1604 series are multi-functional step-down DC/DC converters with built-in speed, low ON resistance drivers. A more than 1A output current is possible using an externally coil, diode and capacitor.
Output voltage is set-up by external resistor.（±2.5% accuracy）.
With a 600kHz switching frequency, the size of the external components can be reduced.
Control switches from to PFM during light loads with the AP1604（PWM/PFM switchable）and the series is highly efficient from light loads to large output currents.
In relation to soft-start time external capacitor regulated types.
During stand-by time （CE/SS pin “LOW”）,current consumption is reduced to less than 5μA.
Will be forcibly switched off if used below the stipulated voltage.

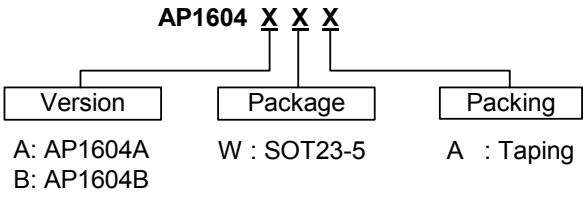
■ Pin Assignment



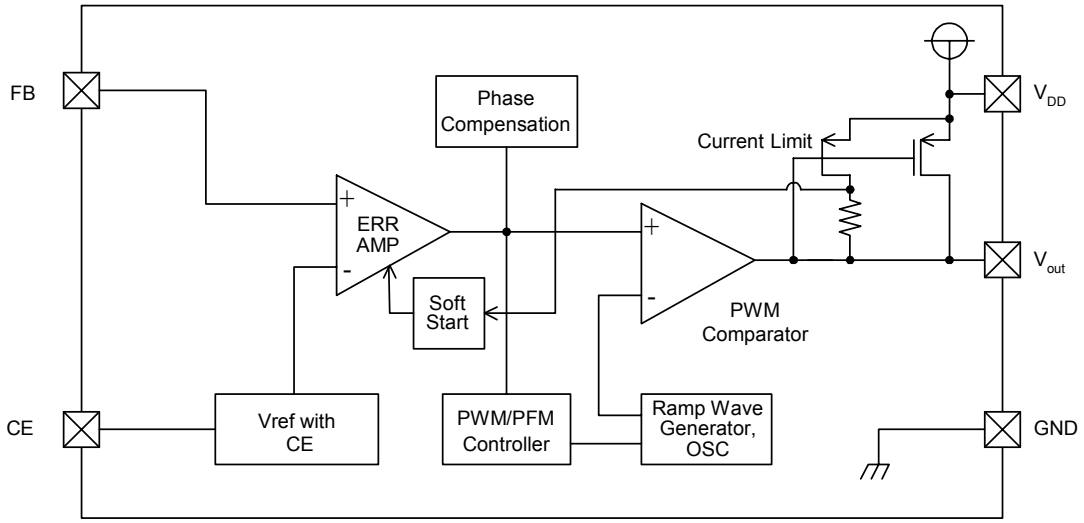
■ Pin Descriptions

PIN NAME	FUNCTION
V_{OUT}	Output Voltage
V_{CC}	Input Supply
GND	Ground
CE/SS	Chip Enable / Soft Start
FB	Feedback pin

■ Ordering Information



■ Block Diagrams



■ Absolute Maximum Ratings

Ta=25°C

SYMBOL	PARAMETER	RATINGS	UNITS
V_{CC}	V_{IN} Pin Voltage	-0.3 ~ 6.5	V
V_{OUT}	V_{OUT} Pin Voltage	-0.3 ~ V_{IN}+0.3	V
V_{FB}	FB Pin Voltage	-0.3 ~ V_{IN}+0.3	V
$V_{CE/SS}$	CE/SS Pin Voltage	-0.3 ~ V_{IN}+0.3	V
Pd	Continuous Total Power Dissipation	Internal limited	
Topr	Operating Ambient Temperature	-25 ~ +80	°C
Tstg	Storage Temperature	-40 ~ +125	°C

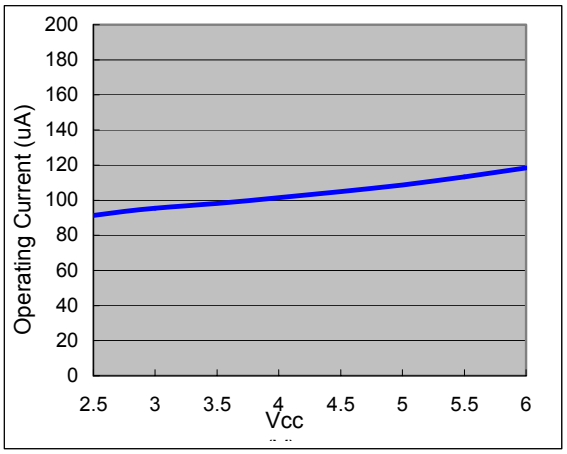
■ Electrical Characteristics

V_{IN}=5V, V_{OUT}＝2V, Load=300mA, Ta=25°C

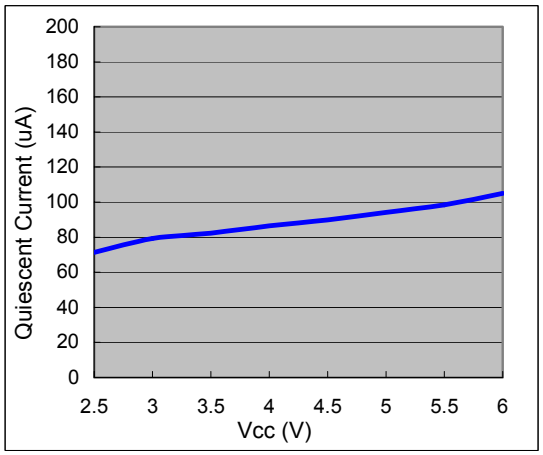
Sym.	Parameter	Conditions	Min.	Typ.	Max.	Units
V_{FB}	FB		0.975	1.0	1.025	V
V_{IN}	Input Voltage		2.2	-	6	V
	Line Regulation	V_{IN}=2.2~6V, Load=10mA	-	-	0.12	%
	Load Regulation	I_{OUT}=10~800mA	-	-	1.2	%
V_{UVLO}	UVLO Voltage（min. operating voltage）	V_{CC}, voltage required to maintain H at V_{OUT}	-	-	2	V
I_{CC}	Operating Current	CE/SS=V_{IN}, No Load	-	100	150	μA
I_{CCQ}	Supply Current	No external components, CE/SS=V_{IN}, V_{FB}=0V	-	90	120	μA
I_{STB}	Stand-by Current	No external components, CE/SS=0V, V_{FB}=0V	-	-	5	μA
I_{CL}	current limit	peak current V_{IN}=5V, V_{OUT}=2V	800	1000	1200	mA
Fosc	Oscillator Frequency	Load=300mA, V_{IN}=5V, V_{OUT}=2V	500	600	700	kHz
MAXDTY	Maximum Duty Ratio		85	90	-	%
PFMDTY	PFM Duty Ratio	NO load	15	25	35	%
V_{CEH}	CE/SS ”High” Voltage	Apply 1.4V (min.) to CE/SS, determine V_{OUT} ”High”	1.4	-	-	V
V_{CEL}	CE/SS ”Low” Voltage	Same as V_{CEH}, determine V_{OUT}/”Low”	-	-	0.6	V
EFFI	Efficiency	V_{CC}=5V, V_{OUT}=3.3V, Load=300mA	-	93	-	%
Rdson	Rdson condition	I_{OUT}=300mA, V_{IN}=5V, V_{OUT}=2V	-	350	450	mΩ

■ Typical Performance Characteristics

Vcc v.s. Operating Current

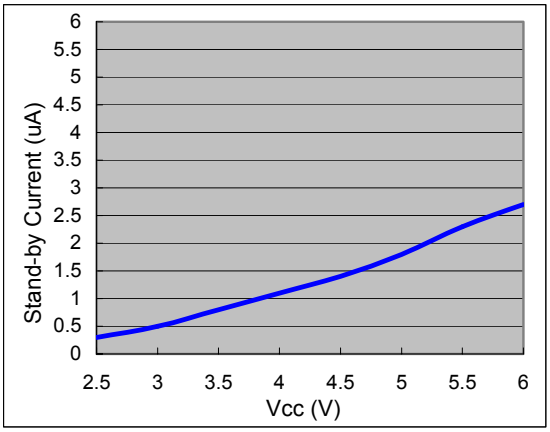


Vcc v.s. Quiescent Current

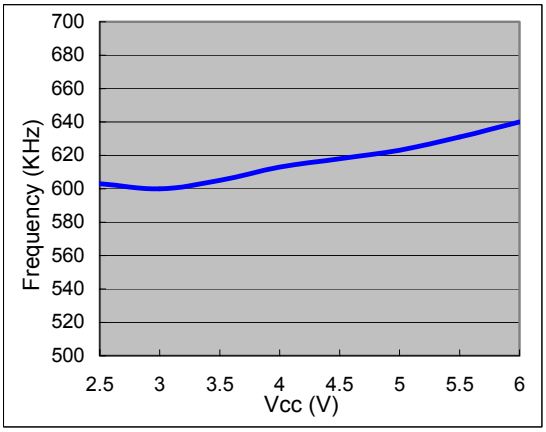


■ Typical Performance Characteristics (Continued)

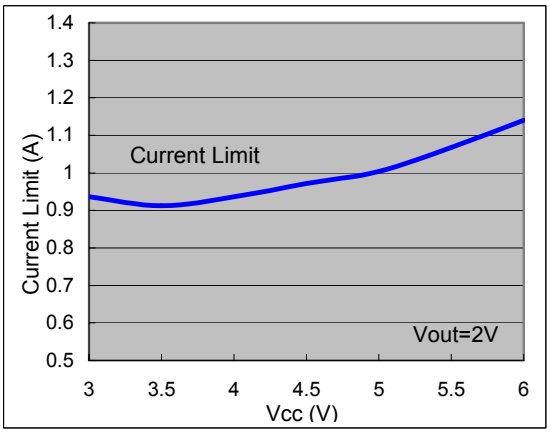
Vcc v.s. Stand-by Current



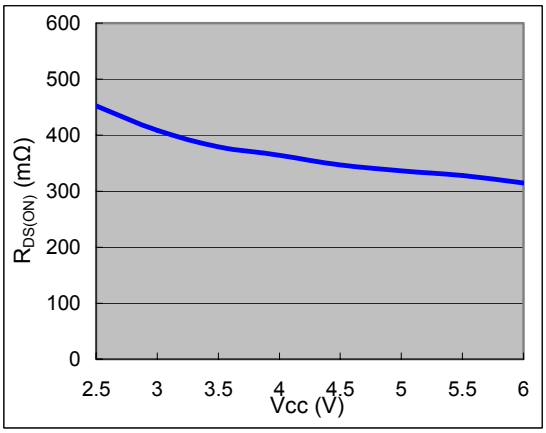
Vcc v.s. Frequency



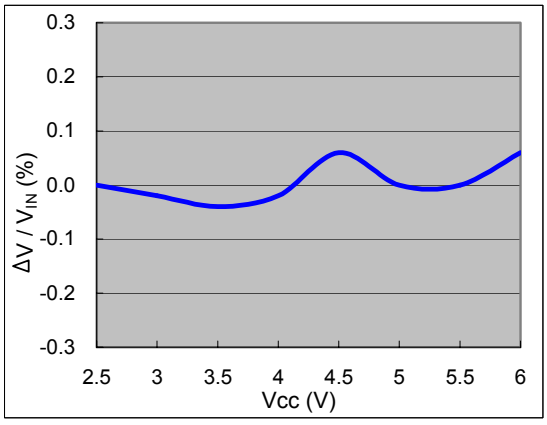
Vcc v.s. Current Limit



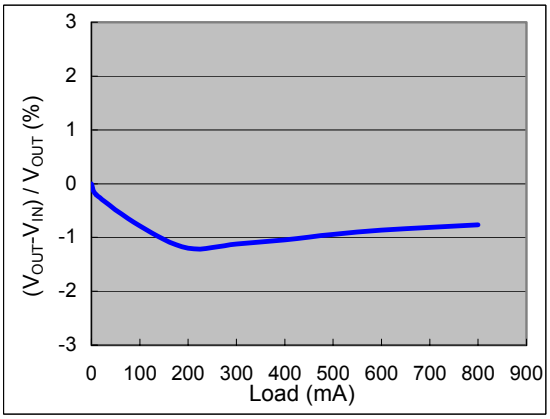
Vcc v.s. $R_{DS(ON)}$



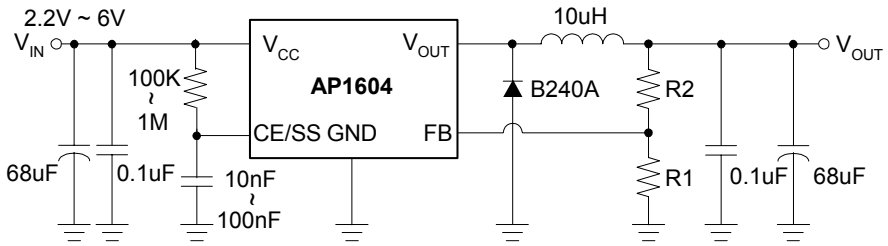
Line Regulation



Load Regulation



■ Typical Application Circuit

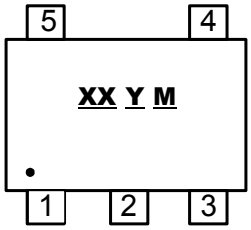


$$Vout = 1 \times (1 + \frac{R2}{R1})$$

R1=100K ~ 200K

■ Marking Information

SOT23-5L



SOT23-5L

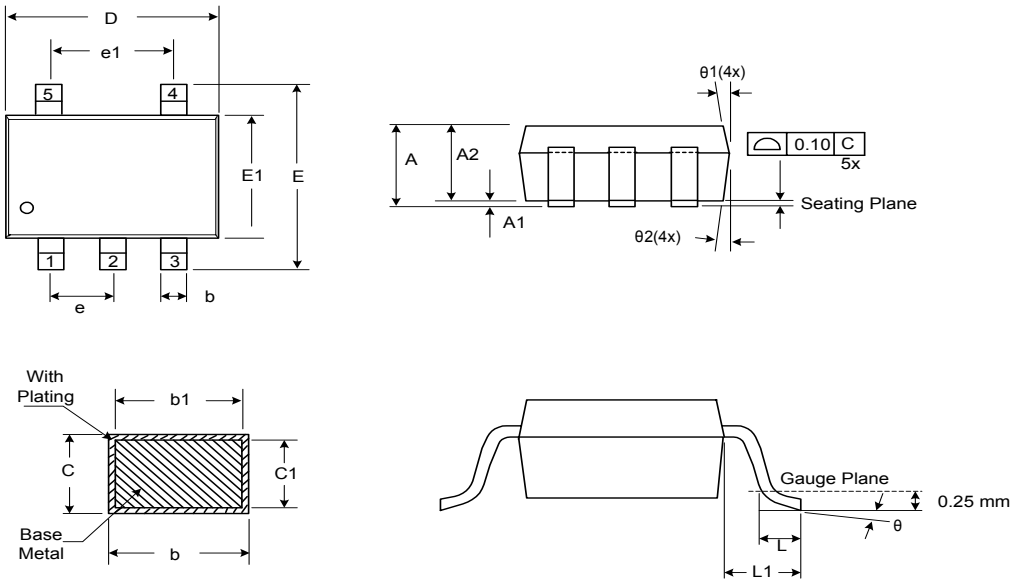
XX : Identification code
(See Appendix)
Y : Year: 0-9
M : Month: A~L

Appendix

Part Number	Package	Identification Code
AP1604A	SOT23-5	ER
AP1604B	SOT23-5	ES

■ Package Information

Package Type: SOT23-5L



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	1.05	1.20	1.35	0.041	0.047	0.053
A1	0.05	0.10	0.15	0.002	0.004	0.006
A2	1.00	1.10	1.20	0.039	0.043	0.047
b	0.25	-	0.55	0.010	-	0.022
b1	0.25	0.40	0.45	0.010	0.016	0.018
c	0.08	-	0.20	0.003	-	0.008
c1	0.08	0.11	0.15	0.003	0.004	0.006
D	2.70	2.85	3.00	0.106	0.112	0.118
E	2.60	2.80	3.00	0.102	0.110	0.118
E1	1.50	1.60	1.70	0.059	0.063	0.067
L	0.35	0.45	0.55	0.014	0.018	0.022
L1	0.60 Ref.			0.024 Ref.		
e	0.95 Bsc.			0.037 Bsc.		
e1	1.90 Bsc.			0.075 Bsc.		
θ	0^o	5^o	10^o	0^o	5^o	10^o
θ 1	3^o	5^o	7^o	3^o	5^o	7^o
θ 2	6^o	8^o	10^o	6^o	8^o	10^o