



FEATURES

- Low Dropout Voltage of 250mV at 300mA
- Guaranteed 300mA Output Current
- Very Low Quiescent Current at about 30uA
- ±2% Output Voltage Accuracy for 1.2V~3.3V
- Needs Only 1µF Capacitor for Stability
- Thermal Shutdown Protection
- Current Limit Protection
- Output Voltage Fast Discharge
- Low-ESR Ceramic Capacitor for Output Stability.
- Tiny SC-70-4L、SC-70-5L、SOT-23 & SOT-23-5L packages
- RoHS Compliant & Halogen Free
- High PSRR

DESCRIPTION

The APE8865 series are low dropout, positive linear regulators with very low quiescent current. The APE8865 can supply 300mA output current with a low dropout voltage at about 250mV.

The APE8865 regulator is able to operate with output capacitors as small as 1µF for stability. Other than the current limit protection APE8865 also offers on chip thermal shutdown feature providing protection against overload or any condition when the ambient temperature exceeds the junction temperature.

The APE8865 series are offering several fixed output voltage types including 1.2V ~ 3.3V.

The APE8865 series are available in low-profile, space-saving SC-70-4L、SC-70-5L、SOT-23 & SOT-23-5L packages.

APPLICATIONS

- DVD/CD-ROMs, CD/RWs
- Wireless Devices
- LCD Modules
- Battery Power Systems
- Card Readers
- XDSL Routers

TYPICAL APPLICATION

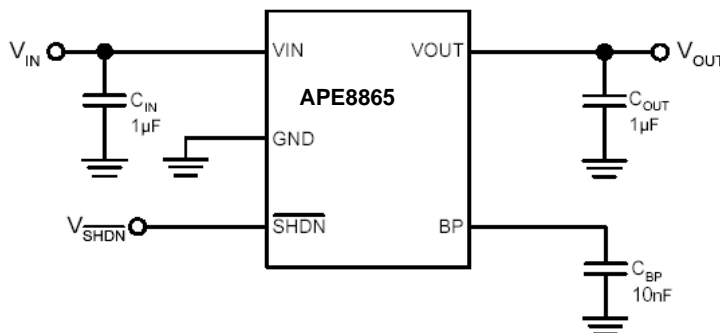


Figure 1. Typical Application Circuit of APE8865

Note : To prevent oscillation, it is recommended to use minimum 1uF X7R or X5R dielectric capacitors if ceramics are used as input / output capacitors.

ORDERING INFORMATION

APE8865X - XX -HF Halogen Free

Package Type	Output Voltage			
N : SOT-23	12 : 1.2V	19 : 1.9V	24 : 2.4V	29 : 2.9V
NR : SOT-23	15 : 1.5V	20 : 2.0V	25 : 2.5V	30 : 3.0V
Y5 : SOT-23-5L	16 : 1.6V	21 : 2.1V	26 : 2.6V	31 : 3.1V
U4 : SC-70-4L	17 : 1.7V	22 : 2.2V	27 : 2.7V	32 : 3.2V
U5 : SC-70-5L	18 : 1.8V	23 : 2.3V	28 : 2.8V	33 : 3.3V

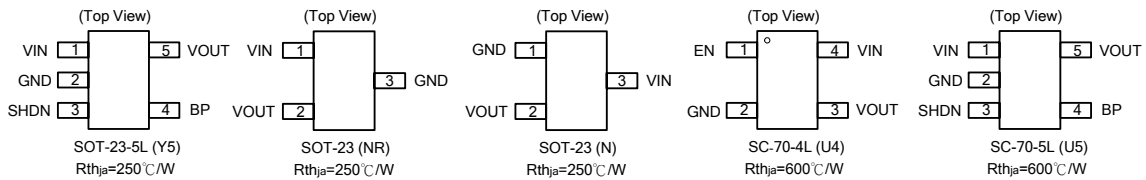
ABSOLUTE MAXIMUM RATINGS

Input Voltage (VIN)	6V
SHDN Voltage (V_{SHDN})	GND - 0.3V to VIN + 0.3V
Power Dissipation (SOT23-5L)	0.4W
(SOT-23)	0.4W
(SC70-4L)	0.16W
(SC70-5L)	0.16W
Storage Temperature Range	-65°C To 150°C
Maximum Junction Temperature	150°C

RECOMMENDED OPERATING CONDITIONS

Input Voltage (VIN)	2.8 to 5.5V
Operating Junction Temperature Range (T_J)	-40 to 125°C
Ambient Temperature (T_A)	-40 to 85°C

PACKAGE INFORMATION



ELECTRICAL SPECIFICATIONS

($V_{IN}=V_{OUT}+1\text{V}$ or $V_{IN}=2.8\text{V}$ whichever is greater, $C_{IN}=1\mu\text{F}$, $C_{OUT}=1\mu\text{F}$, $T_A=25^{\circ}\text{C}$, unless otherwise specified)

Parameter	SYM	TEST CONDITION	MIN	TYP	MAX	UNITS	
Output Voltage Accuracy	ΔV_{OUT}	$I_O=1\text{mA}$	-2	-	2	%	
Current Limit	I_{LIMIT}	$R_{Load}=1\Omega$	300	-	-	mA	
Quiescent Current	I_Q	$I_O=0\text{mA}$	-	30	50	μA	
Dropout Voltage (Note 1)	V_{DROP}	$I_O=300\text{mA}$	$1.2\text{V} \leq V_{OUT} \leq 2.0\text{V}$	-	1000	-	mV
			$2.0\text{V} < V_{OUT} \leq 2.8\text{V}$	-	350	-	
			$2.8\text{V} < V_{OUT} \leq 3.3\text{V}$	-	250	-	
Line Regulation	ΔV_{LINE}	$I_O=1\text{mA}$, $V_{IN}=V_{OUT}+1\text{V}$ to 5V	-	1	5	mV	
Load Regulation (Note 2)	ΔV_{LOAD}	$I_O=0\text{mA}$ to 300mA	-	6	20	mV	
Ripple Rejection	PSRR	$I_O=1\text{mA}$, $C_{OUT}=1\mu\text{F}$, $f_{RIPPLE}=100\text{Hz}$	-	-73	-	dB	
		$f_{RIPPLE}=10\text{KHz}$	-	-50	-		
Temperature Coefficient	TC	$I_{OUT}=1\text{mA}$, $V_{IN}=5\text{V}$	-	50	-	ppm/ $^{\circ}\text{C}$	
Thermal Shutdown Temperature	TSD		-	160	-	$^{\circ}\text{C}$	
Thermal Shutdown Hysteresis	ΔTSD		-	25	-	$^{\circ}\text{C}$	
Shutdown Pin Current	I_{SHDN}		-	-	0.1	μA	
Shutdown Pin Voltage (ON)	$V_{SHDN(ON)}$		1.4	-	-	V	
Shutdown Pin Voltage (OFF)	$V_{SHDN(OFF)}$		-	-	0.4	V	
Shutdown Exit Delay Time	ΔT	$C_{BP}=0.1\mu\text{F}$, $C_{OUT}=1\mu\text{F}$, $I_{OUT}=30\text{mA}$	-	150	-	μs	

Note 1 : The dropout voltage is defined as $V_{IN}-V_{OUT}$, which is measured when V_{OUT} drop about 100mV.

Note 2 : Regulation is measured at a constant junction temperature by using 30ms current pulse and load regulation in the load range from 0mA to 300mA.



PIN DESCRIPTIONS

PIN SYMBOL	PIN DESCRIPTION
VIN	Power is supplied to this device from this pin which is required an input filter capacitor. In general, the input capacitor in the range of 1 μ F to 10 μ F is sufficient.
VOUT	The output supplies power to loads. The output capacitor is required to prevent output voltage unstable. The APE8865 is stable with an output capacitor 1 μ F or greater. The larger output capacitor will be required for application with large transit load to limit peak voltage transients, besides could reduce output noise, improve stability, PSRR.
GND	Common ground pin
BP	Reference Noise Bypass (the Bypass Capacitor \geq 1nF)
$\overline{\text{SHDN}}$	Chip Enable (Active High)

BLOCK DIAGRAM

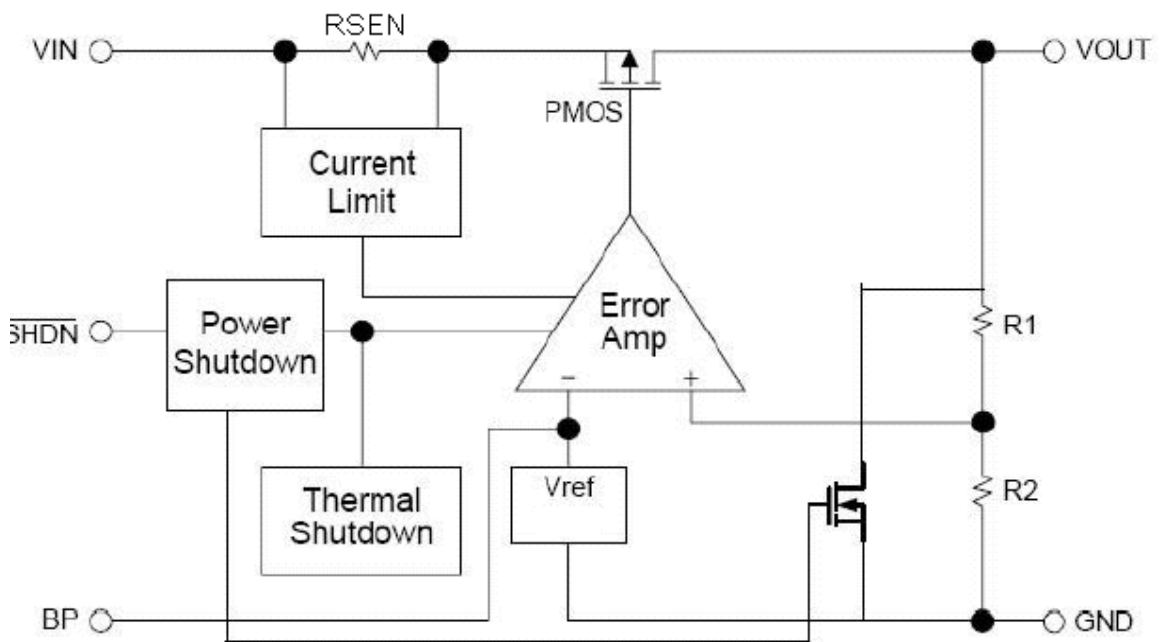


Figure 2. Block Diagram of APE8865 With Auto Discharge



Application Information

The APE8865 series are low dropout linear regulators that could provide 300mA output current at dropout voltage about 300mV. Besides, current limit and on chip thermal shutdown features provide protection against any combination of overload or ambient temperature that could exceed junction temperature.

1. Output and Input Capacitor

The APE8865 regulator is designed to be stable with a wide range of output capacitors. The ESR of the output capacitor affects stability. Larger value of the output capacitor decreases the peak deviations and provides to improve transition response for larger current changes.

The capacitor types (aluminum, ceramic, and tantalum) have different characterizations such as temperature and voltage coefficients. All ceramic capacitors are manufactured with a variety of dielectrics, each with different behavior across temperature and applications. Common dielectrics used are X5R, X7R and Y5V. It is recommended to use 1uF X5R or X7R dielectric ceramic capacitors with 30mΩ to 50mΩ ESR range between device outputs to ground for transient stability. The APE8865 is designed to be stable with low ESR ceramic capacitors and higher values of capacitors and ESR could improve output stability.

So the ESR of output capacitor is very important because it generates a zero to provide phase lead for loop stability.

There are no requirements for the ESR on the input capacitor, but its voltage and temperature coefficient have to be considered for device application environment.

2. Protection Features

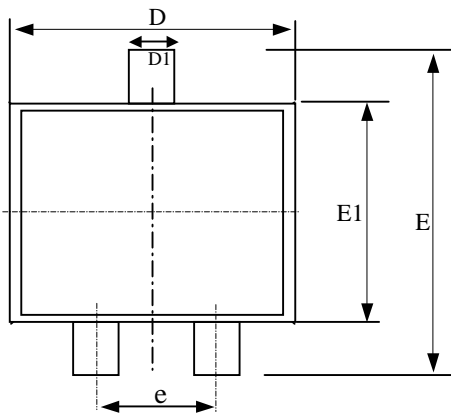
In order to prevent overloading or thermal condition from damaging the device, APE8865 regulator has internal thermal and current limiting functions designed to protect the device. It will rapidly shut off PMOS pass element during overloading or over temperature condition.

3. Thermal Consideration

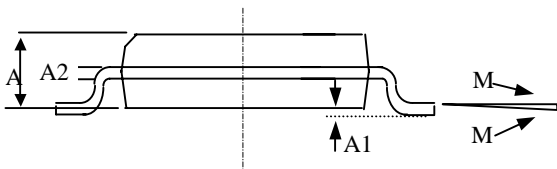
The power handling capability of the device will be limited by maximum operation junction temperature (125°C). The power dissipated by the device will be estimated by $PD = I_{OUT} \times (V_{IN} - V_{OUT})$. The power dissipation should be lower than the maximum power dissipation listed in "Absolute Maximum Ratings" section.



Package Outline : SOT-23

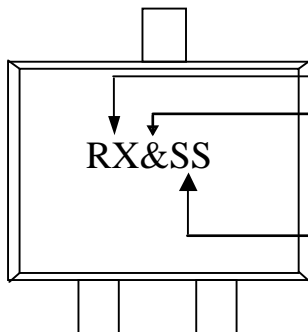


SYMBOLS	Millimeters		
	MIN	NOM	MAX
A	0.88	--	1.30
A1	0.00	--	0.10
A2	0.08	--	0.25
D1	0.30	0.40	0.50
e	1.70	2.00	2.30
D	2.70	2.90	3.10
E	2.20	2.60	3.00
E1	1.20	1.40	1.60
M	0°	--	10°



- 1.All Dimension Are In Millimeters.
- 2.Dimension Does Not Include Mold Protrusions.

Part Marking Information & Packing : SOT-23



Part Number : RX
 RL : APE8865N ; R1 : APE8865NR
 VOUT

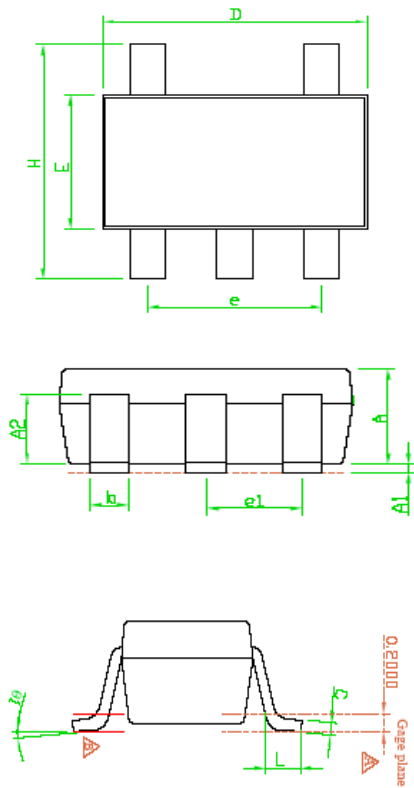
Date Code :
 SS:2004,2008,2012...
 SS:2003,2007,2011...
 SS:2002,2006,2010...
 SS:2001,2005,2009...

V _{OUT}	Identification Code	V _{OUT}	Identification Code
1.2V	2	2.4V	T
1.5V	5	2.5V	F
1.6V	S	2.6V	f
1.7V	X	2.7V	D
1.8V	A	2.8V	E
1.9V	a	2.9V	h
2.0V	e	3.0V	H
2.1V	B	3.1V	x
2.2V	C	3.2V	U
2.3V	v	3.3V	l



ADVANCED POWER ELECTRONICS CORP.

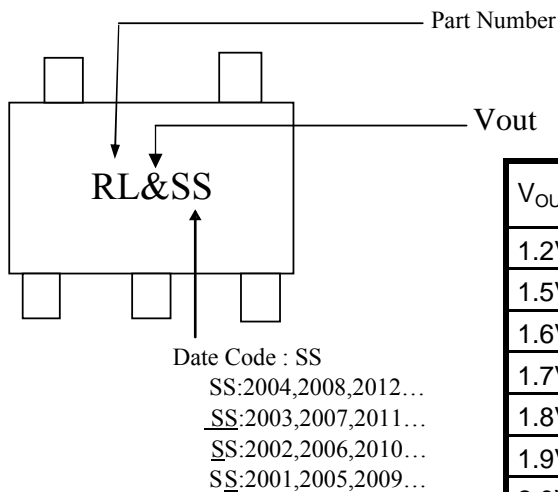
Package Outline : SOT-23-5L



SYMBOLS	Millimeters		
	MIN	NOM	MAX
A	1.00	1.10	1.30
A1	0.00	---	0.10
A2	0.70	0.80	0.90
b	0.30	0.40	0.50
C	0.10	0.15	0.25
D	2.70	2.90	3.10
E	1.40	1.60	1.80
e	---	1.90(TYP)	---
H	2.60	2.80	3.00
L	0.37	---	---
$\theta 1$	0°	5°	9°
e1	---	0.95(TYP)	---

- Note 1 : Package Body Sizes Exclude Mold Flash Protrusions or Gate Burrs.
- Note 2 : Tolerance ± 0.1000 mm(4mil) Unless Otherwise Specified.
- Note 3 : Coplanarity : 0.1000 mm
- Note 4 : Dimension L Is Measured in Gage plane.

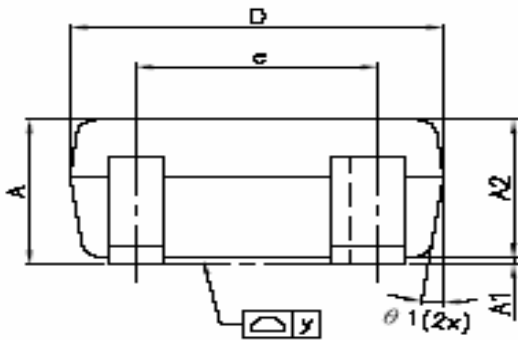
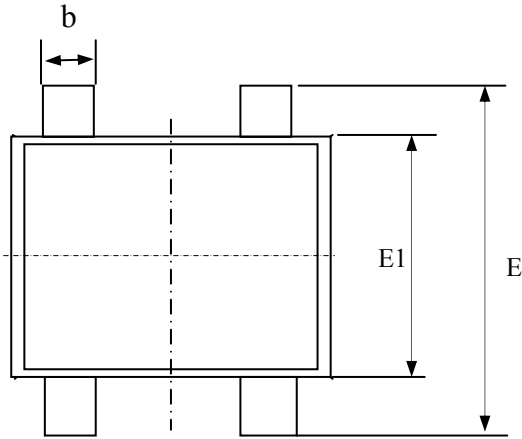
Part Marking Information & Packing : SOT-23-5L



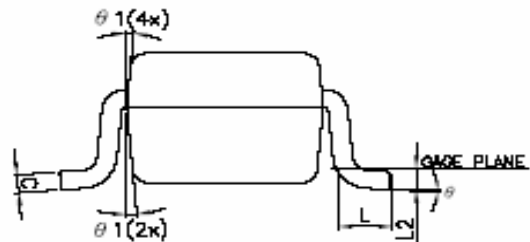
V _{OUT}	Identification Code	V _{OUT}	Identification Code
1.2V	2	2.4V	T
1.5V	5	2.5V	F
1.6V	S	2.6V	f
1.7V	X	2.7V	D
1.8V	A	2.8V	E
1.9V	a	2.9V	h
2.0V	e	3.0V	H
2.1V	B	3.1V	x
2.2V	C	3.2V	U
2.3V	v	3.3V	I



Package Outline : SC-70-4L

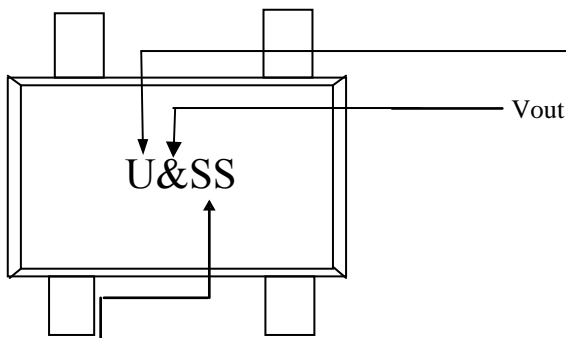


SYMBOLS	Millimeters		
	MIN	NOM	MAX
A	0.80	—	1.10
A1	0.00	—	0.10
A2	0.70	0.90	1.00
b	0.25	0.30	0.40
C	0.10	—	0.26
D	1.80	2.00	2.20
E1	1.15	1.25	1.35
E	1.80	2.10	2.40
e	—	1.30	—
L	0.15	0.30	0.45
L2	—	0.15	—
y	—	—	0.10
θ	0°	—	8°
θ1	4°	—	12°



- 1.All Dimension Are In Millimeters.
- 2.Dimension Does Not Include Mold Protrusions.

Part Marking Information & Packing : SC-70-4L



Date Code : SS

SS:2004,2008,2012...

SS:2003,2007,2011...

SS:2002,2006,2010...

SS:2001,2005,2009...

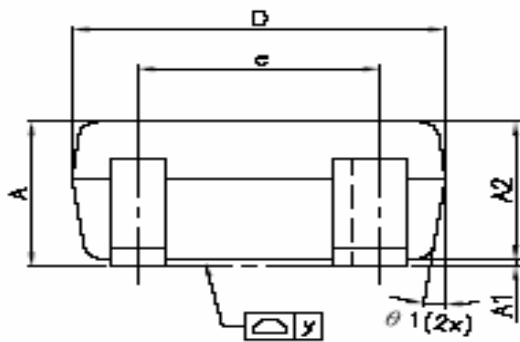
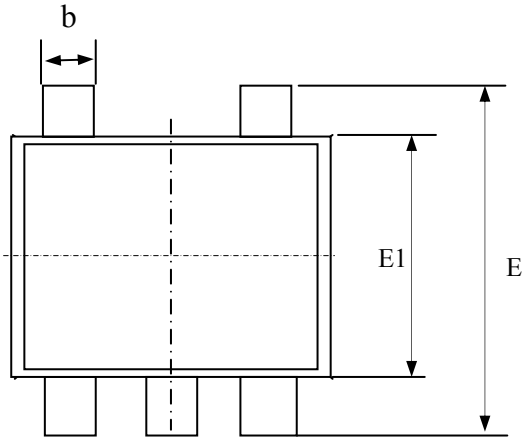
"A~Z" showed on 3rd position --> week 1 ~ week 26,

"A~Z" showed on 4th position --> week 27 ~ week 52.

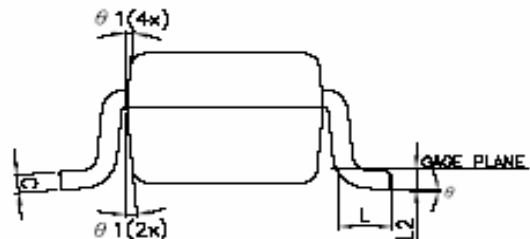
V _{OUT}	Identification Code	V _{OUT}	Identification Code
1.2V	B	2.4V	T
1.5V	C	2.5V	F
1.6V	S	2.6V	f
1.7V	X	2.7V	w
1.8V	D	2.8V	G
1.9V	a	2.9V	h
2.0V	e	3.0V	H
2.1V	b	3.1V	x
2.2V	O	3.2V	U
2.3V	v	3.3V	I



Package Outline : SC-70-5L



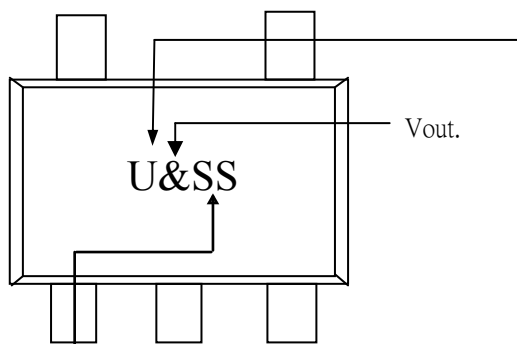
SYMBOLS	Millimeters		
	MIN	NOM	MAX
A	0.80	—	1.10
A1	0.00	—	0.10
A2	0.70	0.90	1.00
b	0.25	0.30	0.40
C	0.10	—	0.26
D	1.80	2.00	2.20
E1	1.15	1.25	1.35
E	1.80	2.10	2.40
e	—	1.30	—
L	0.15	0.30	0.45
L2	—	0.15	—
y	—	—	0.10
θ	0°	—	8°
θ1	4°	—	12°



- 1.All Dimension Are In Millimeters.
- 2.Dimension Does Not Include Mold Protrusions.

C

Part Marking Information & Packing : SC-70-5L



Date Code : SS

SS:2004,2008,2012...

SS:2003,2007,2011...

SS:2002,2006,2010...

SS:2001,2005,2009...

"A~Z" showed on 3rd position --> week 1 ~ week 26,

"A~Z" showed on 4th position --> week 27 ~ week 52.

V _{OUT}	Identification Code	V _{OUT}	Identification Code
1.2V	B	2.4V	T
1.5V	C	2.5V	F
1.6V	S	2.6V	f
1.7V	X	2.7V	w
1.8V	D	2.8V	G
1.9V	a	2.9V	h
2.0V	e	3.0V	H
2.1V	b	3.1V	x
2.2V	O	3.2V	U
2.3V	v	3.3V	I