150mA HIGH PSRR LOW NOISE LDO WITH ENABLE

Description

The AP7340 is low dropout regulator with high output voltage accuracy, low R_{DSON}, high PSRR, low output noise and low quiescent current. This regulator is based on a CMOS process.

The AP7340 includes a voltage reference, error amplifier, current limit circuit and an enable input to turn it on and off. With the integrated resistor network fixed output voltage versions can be delivered.

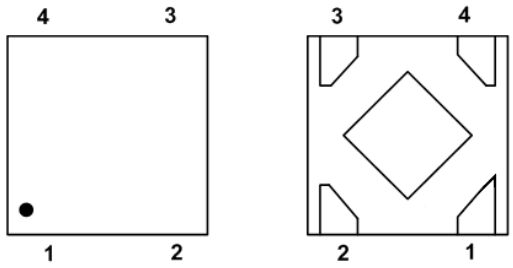
With its low power consumption and line and load transient response the AP7340 is well suited for low power handheld communication equipment.

The AP7340 is packaged in a X2-DFN1010-4 package and allows for smallest footprint and dense PCB layout.

Features

- Low V_{IN} and wide V_{IN} range: 1.7V to 5.25V
- Guarantee Output Current,150mA
- V_{OUT} accuracy ±1%
- Ripple Rejection 75dB at 1kHz
- Low output noise, 60uVrms from 10Hz to 100kHz
- Quiescent current as low as 35μA
- V_{OUT} fixed 1.1V to 3.6V
- **Totally Lead-Free & and Fully RoHS Compliant (Note 1)**
- **Halogen and Antimony Free, Green Device (Note 2)**

Pin Assignments



Top View **X2-DFN1010-4** **Bottom View**

PIN1 – V_{OUT}, PIN2 – GND, PIN3 – EN, PIN4 – V_{IN}

Applications

- Smart phone/PAD
- RF supply
- Cameras
- Portable Video
- Portable Media player
- Wireless adapter
- Wireless communication

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free,"Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Typical Applications Circuit

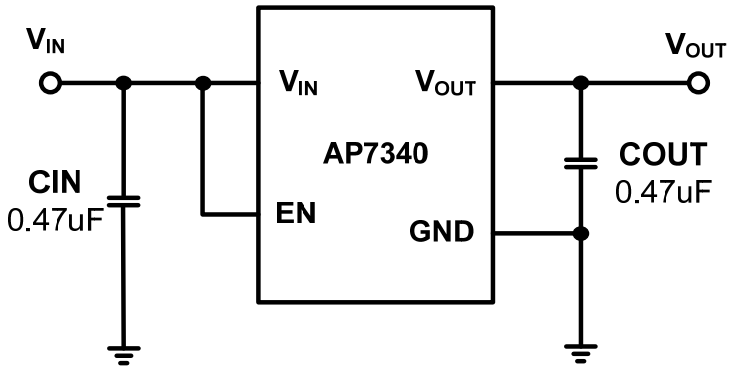
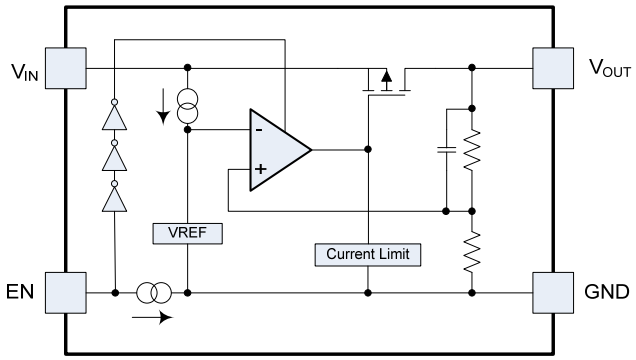


Figure 1 Typical Application Circuit

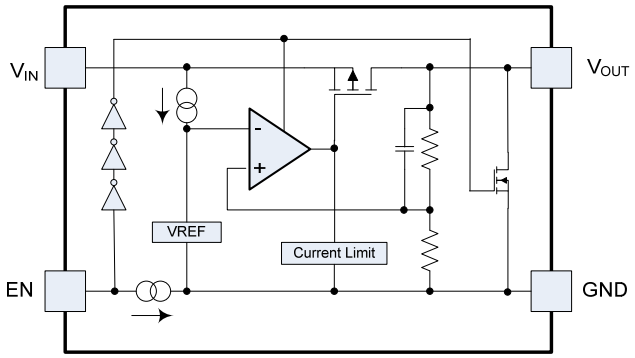
Pin Descriptions

Pin Name	PIN No	Function
	X2-DFN1010-4	
V_{OUT}	1	Power Output Pin
GND	2	Ground
EN	3	Enable pin. This pin should be driven either high or low and must not be floating. Driving this pin high enables the regulator, while pulling it low puts the regulator into shutdown mode
V_{IN}	4	Power Input pin
	Thermal PAD	In PCB layout, prefer to use large copper area to cover this pad for better thermal dissipation, then connect this area to GND or leave it open. However do not use it as GND electrode function alone.

Functional Block Diagram



AP7340 (Non discharge)



AP7340D (with discharge)

Absolute Maximum Ratings (Note 4) (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Ratings	Unit
V_{IN}	Input Voltage	6.0	V
V_{CE}	Input Voltage EN	6.0	V
V_{OUT}	Output Voltage	-0.3 to V_{IN} +0.3	V
I_{OUT}	Output Current	300	mA
P_D	Power Dissipation	400	mW
T_A	Operating Temperature	-40 to +85	°C
T_{STG}	Storage Temperature	-55 to +125	°C

Note: 4. a). Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

b). Ratings apply to ambient temperature at 25°C . The JEDEC High-K board design used to derive this data was a 2 inch x 2 inch multilayer board with 1-ounce internal power and ground planes and 2-ounce copper traces on the top and bottom of the board.

Recommended Operating Conditions (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Min	Max	Unit
V_{IN}	Input Voltage	1.7	5.25	V
I_{OUT}	Output Current	0	150	mA
T_A	Operating Ambient Temperature	-40	+85	°C

Electrical Characteristics

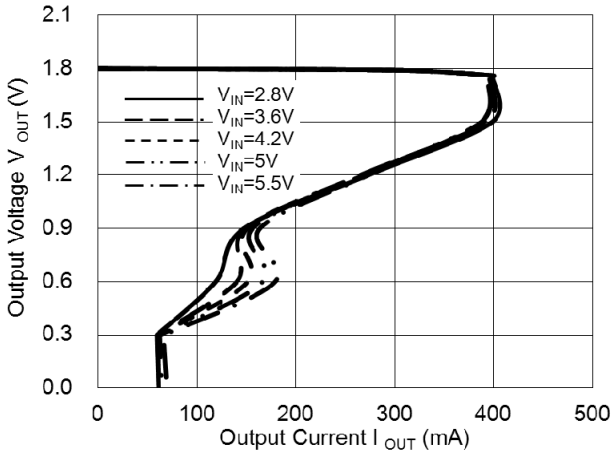
(V_{EN} = V_{IN} = V_{OUT} +1.0V, C_{IN} = C_{OUT} 0.47µF, I_{OUT} = 1.0mA @T_A = +25°C, unless otherwise specified.)

Parameter	Conditions		Min	Typ	Max	Units
Input Voltage	T_A = -40°C to +85°C		1.7		5.25	V
Output Voltage Accuracy (Note 11)	V_{IN} = (V_{OUT} – Nom +1.0V) to 5.25V, I_{OUT} = 1mA to 150mA	T_A = +25°C	-1		1	%
		T_A = -40°C to +85°C	-1.5		+1.5	
Line Regulation ($dV_{OUT}/dV_{IN}/V_{OUT}$)	V_{IN} = (V_{OUT} – Nom +1.0V) to 5.25V, I_{OUT} = 1.0mA			0.02	0.1	%/V
Load Regulation ($dV_{OUT}/V_{OUT}/dI_{OUT}$)	V_{IN} = V_{OUT} - Nom +1.0V, I_{OUT} = 1mA to 150mA			0.5	1.0	%/A
Quiescent Current (Note 6)	I_{OUT} = 0mA			35	50	uA
	I_{OUT} = 150mA			60	100	
$I_{STANDBY}$	V_{EN} = 0V (Disabled)			0.01	1.0	uA
Output Current			150			mA
Fold-back Short Current (Note 7)	V_{OUT} short to ground			55		mA
PSRR (Note 8)	V_{IN} = [V_{OUT}+1V] VDC + 0.2Vp-pAC, V_{OUT} ≥1.8V, I_{OUT} = 30mA	f = 1kHz		75		dB
Output Noise Voltage (Note 8) (Note 9)	BW = 10Hz to 100kHz, I_{OUT} = 30mA			60		µVrms
Dropout Voltage (Note 5)	I_{OUT} = 150mA	1.1V ≤ V_{OUT} < 1.5V		0.50	0.62	V
		1.5V ≤ V_{OUT} < 1.7V		0.38	0.47	
		1.7V ≤ V_{OUT} < 2.0V		0.34	0.42	
		2.0V ≤ V_{OUT} < 2.5V		0.28	0.36	
		2.5V ≤ V_{OUT} < 2.8V		0.22	0.30	
		2.8V ≤ V_{OUT} ≤ 3.6V		0.21	0.27	
Output Voltage Temperature Coefficient	I_{OUT} = 30mA, T_A = -40°C to +85°C			±30		ppm/C
EN Input Low Voltage			0		0.5	V
EN Input High Voltage			1.3		5.25	V
EN Input Leakage	V_{EN} = 0, V_{IN} = 5.0V or V_{EN} = 5.0V, V_{IN} = 0V		-1.0		+1.0	µA
On Resistance of N-channel for auto-discharge (Note 10)	V_{IN} = 4.0V V_{EN} = 0V (Disabled)			30		Ω

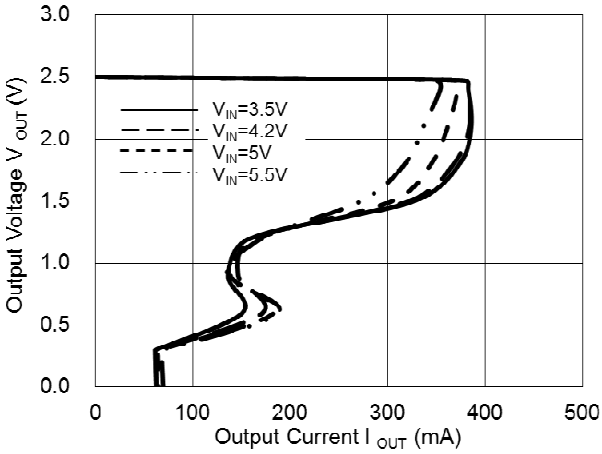
Notes:
5. Dropout voltage is the voltage difference between the input and the output at which the output voltage drops 2% below its nominal value.
6. Quiescent current is defined here is the difference in current between the input and the output.
7. Short circuit current is measured with V_{OUT} pulled to GND.
8. This specification is guaranteed by design.
9. To make sure lowest environment noise minimizes the influence on noise measurement.
10. AP7340 has 2 options for output, Built-in discharge and non-discharge
11. Potential multiple grades based on following output voltage accuracy.

Typical Characteristics

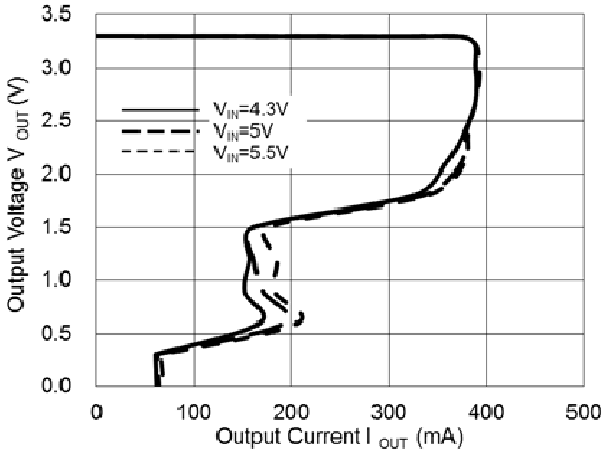
Output Voltage vs. Output Current
AP7340-18



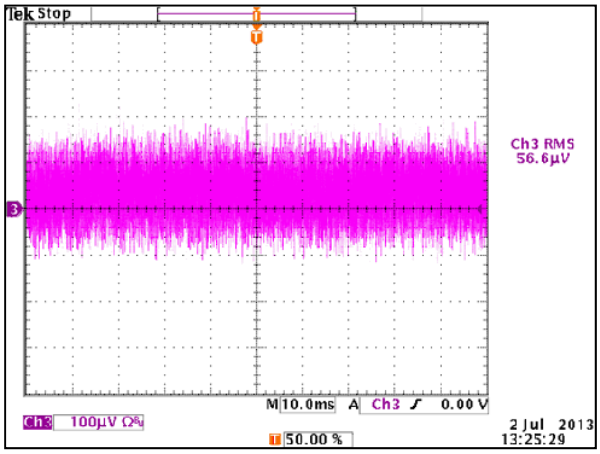
Output Voltage vs. Output Current
AP7340-25



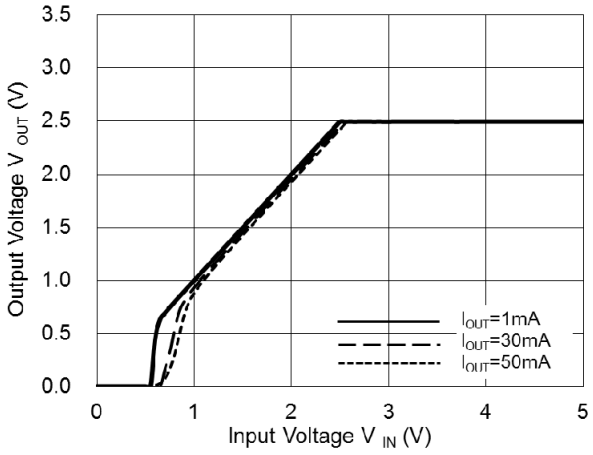
Output Voltage vs. Output Current
AP7340-33



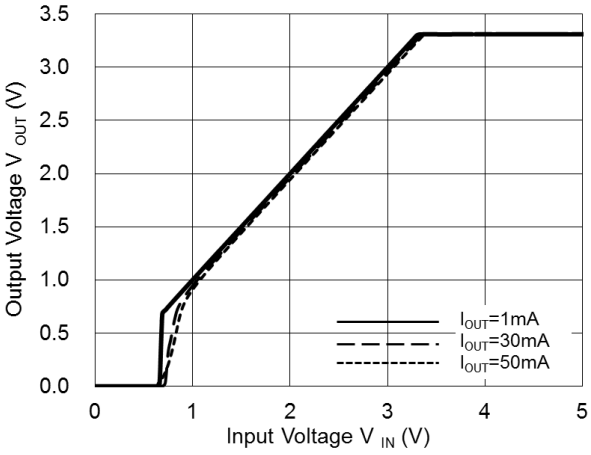
Output Noise (AP7340-33)



Output Voltage vs. Intput Voltage
AP7340-25

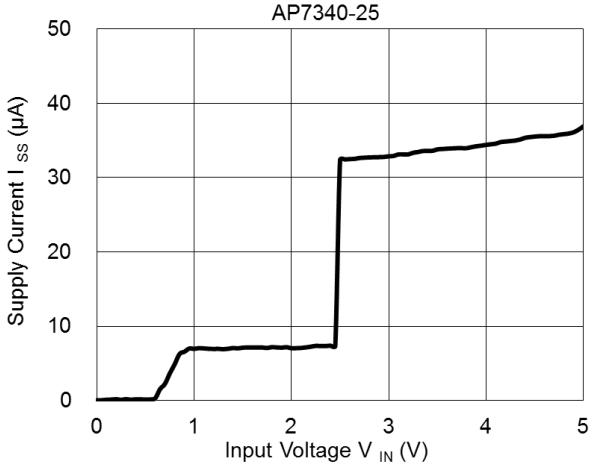


Output Voltage vs. Intput Voltage
AP7340-33

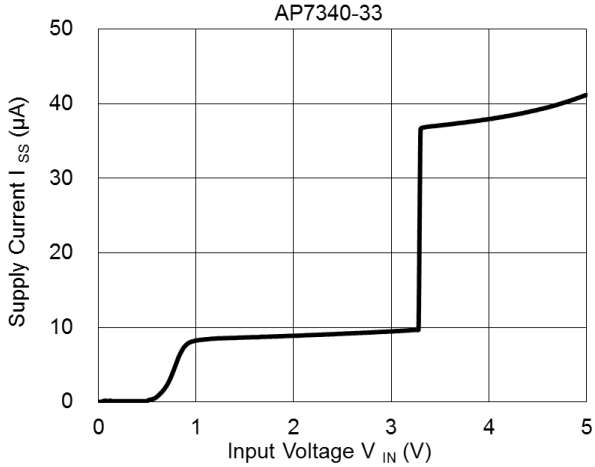


Typical Characteristics (cont.)

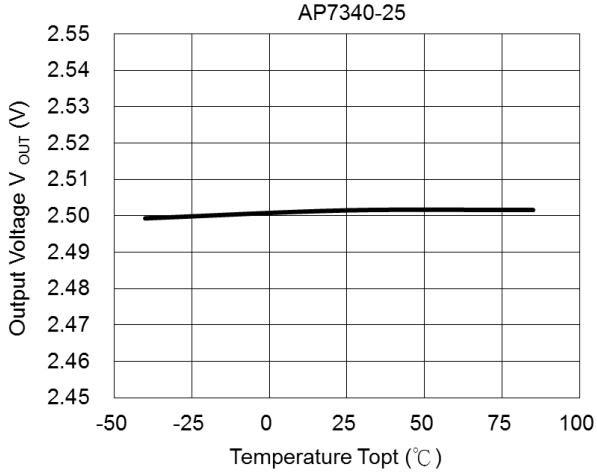
Supply Current vs. Input Voltage
AP7340-25



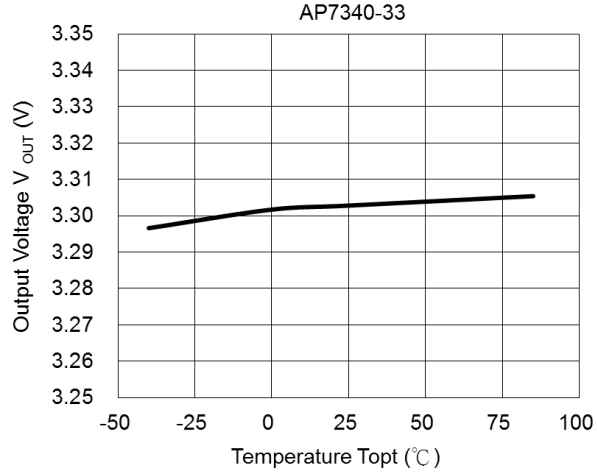
Supply Current vs. Input Voltage
AP7340-33



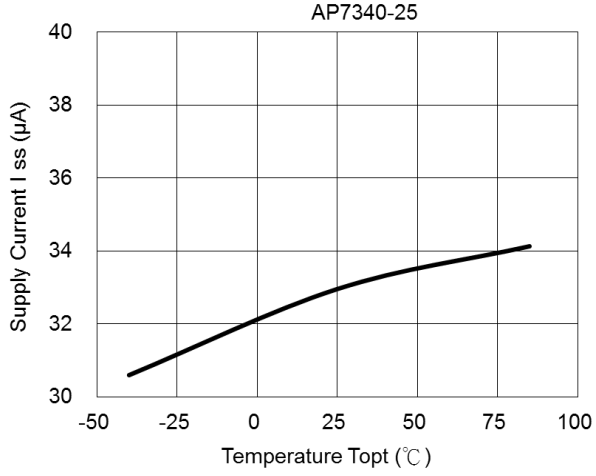
Output Voltage vs. Temperature
AP7340-25



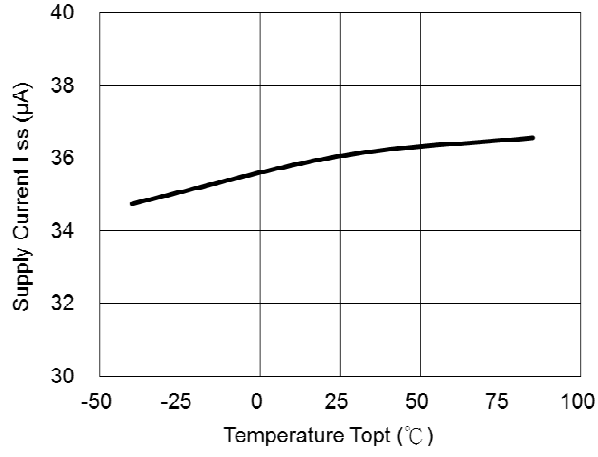
Output Voltage vs. Temperature
AP7340-33



Supply Current vs. Temperature
AP7340-25

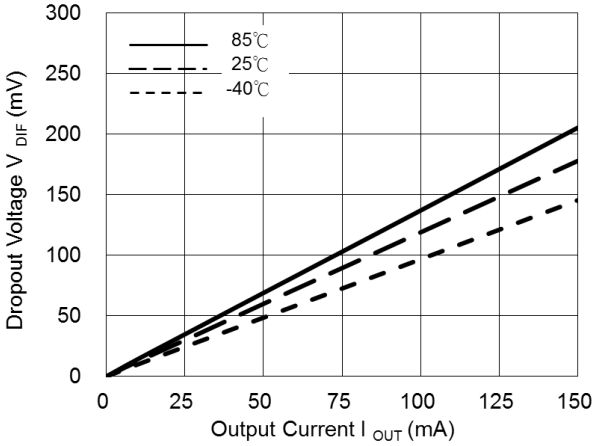


Supply Current vs. Temperature
AP7340-33

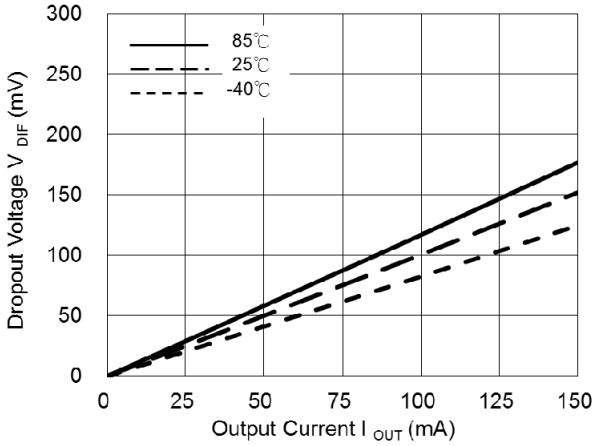


Typical Characteristics (cont.)

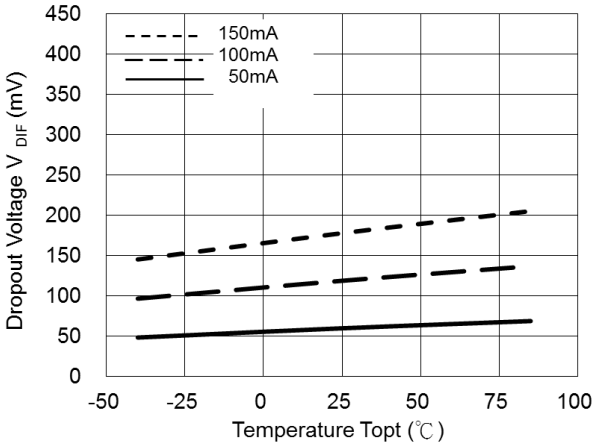
Dropout Voltage vs. Output Current
AP7340-25



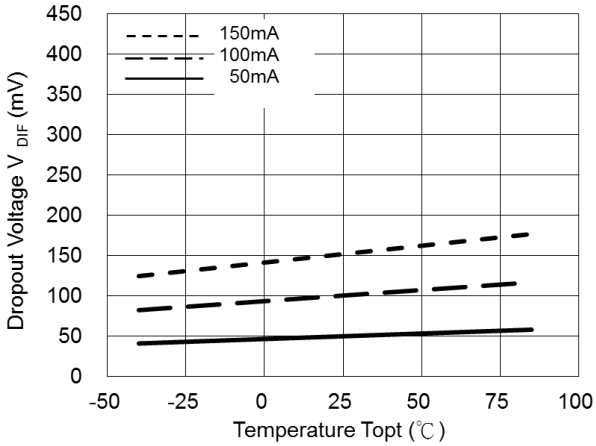
Dropout Voltage vs. Output Current
AP7340-33



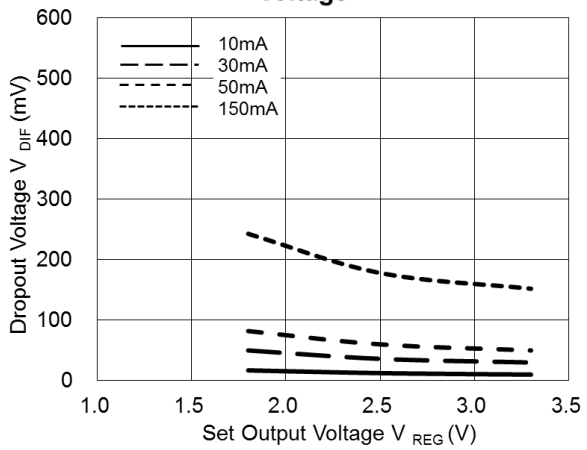
Dropout Voltage vs. Temperature
AP7340-25



Dropout Voltage vs. Temperature
AP7340-33



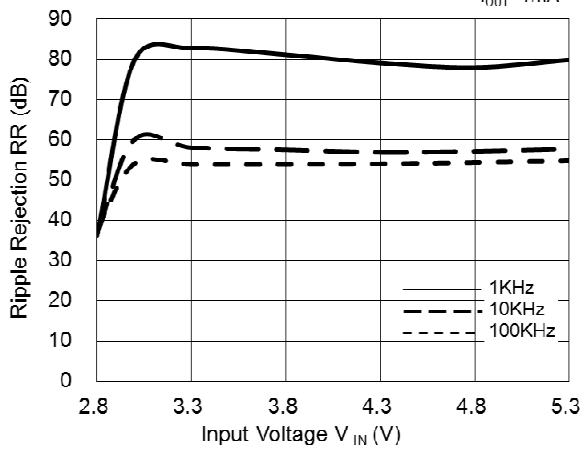
Dropout Voltage vs. Set Output Voltage



Typical Characteristics (cont.)

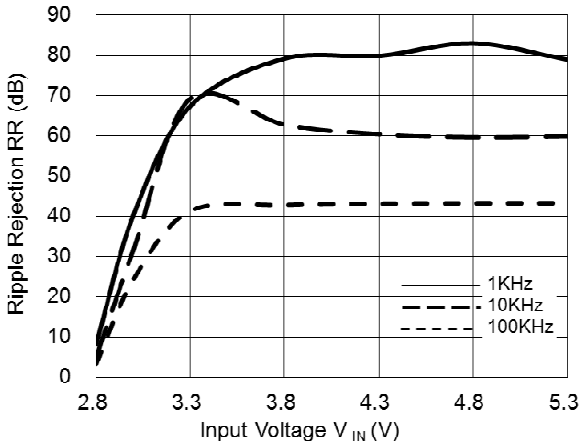
Ripple Rejection vs. Input Bias Voltage

AP7340-28 I_{OUT}=1mA



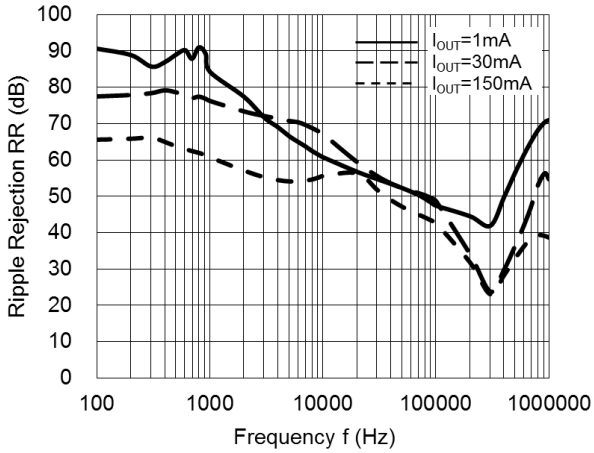
Ripple Rejection vs. Input Bias Voltage

AP7340-28 I_{OUT}=30mA



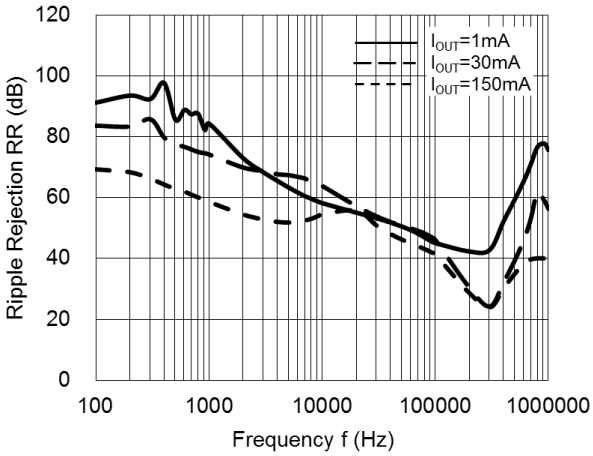
Ripple Rejection vs. Frequency

AP7340-25



Ripple Rejection vs. Frequency

AP7340-33



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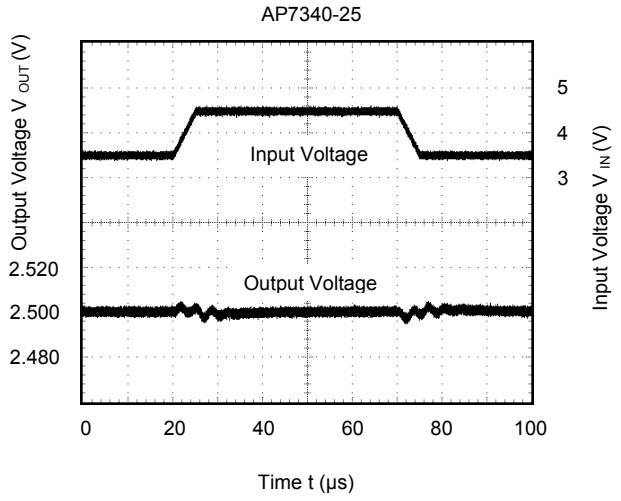

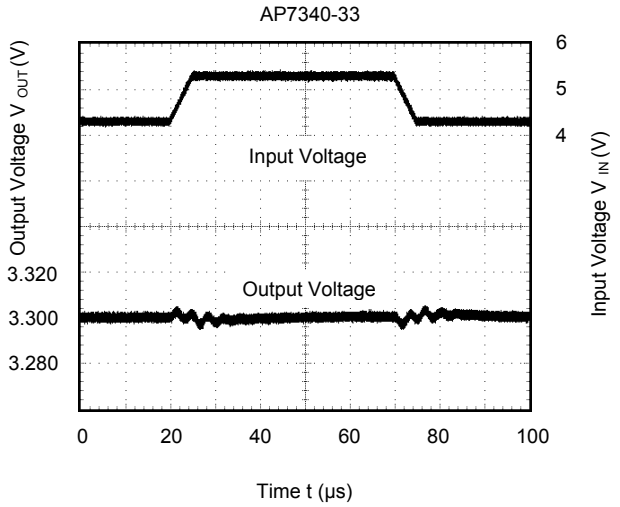

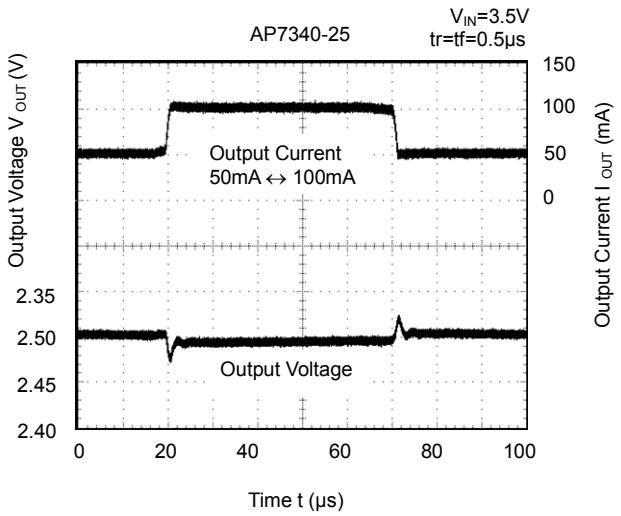

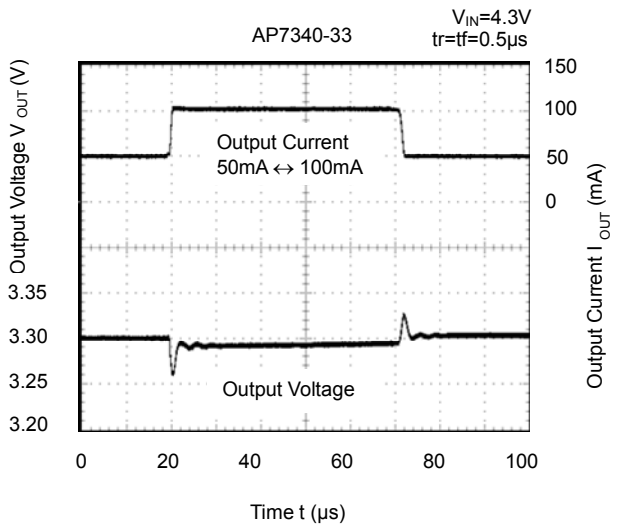

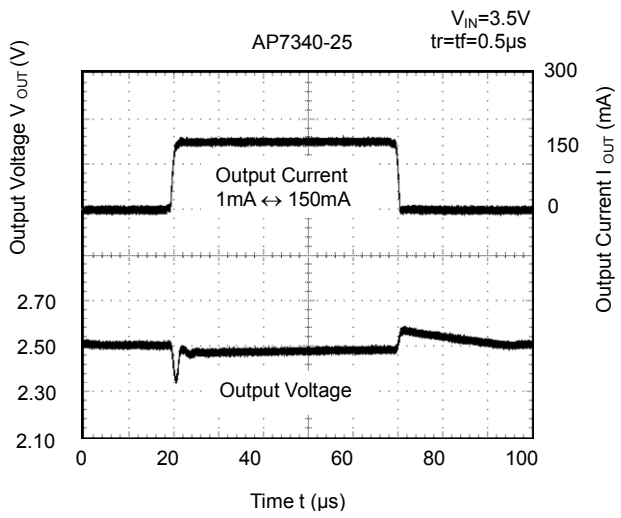

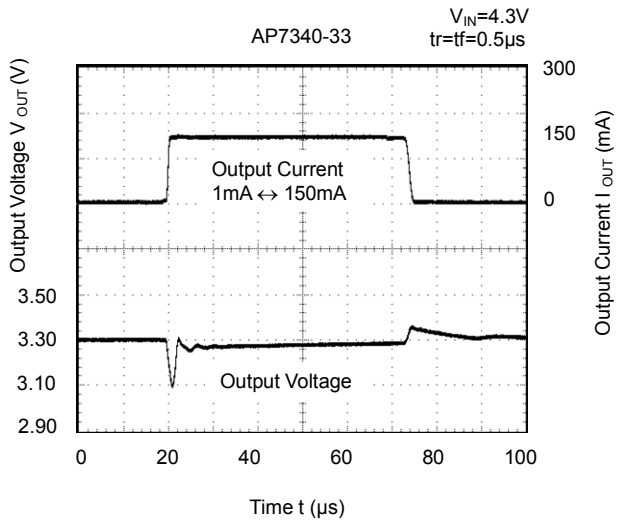

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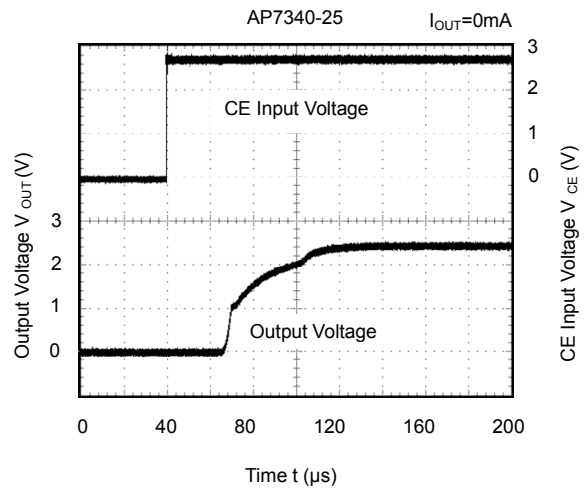
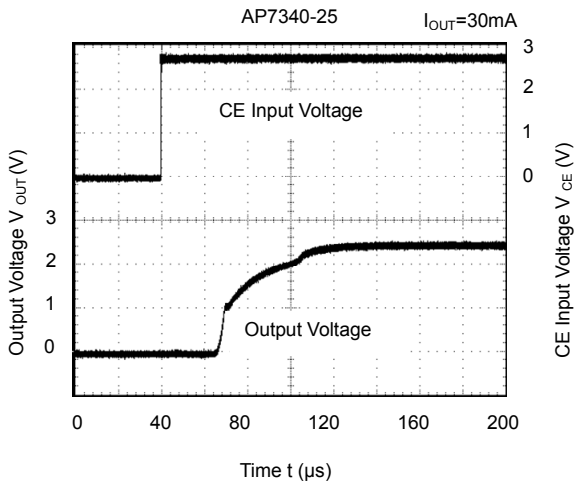
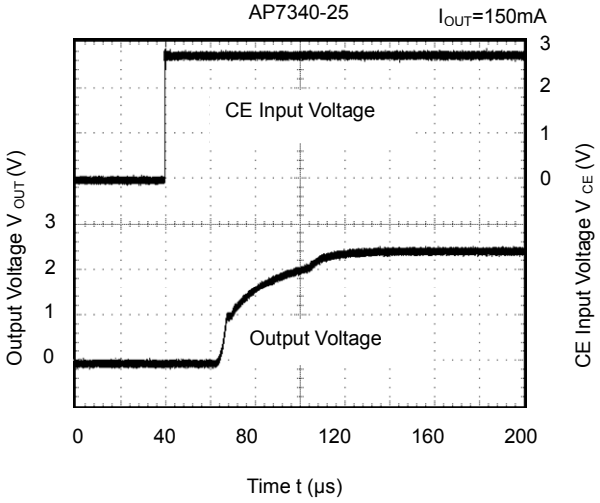
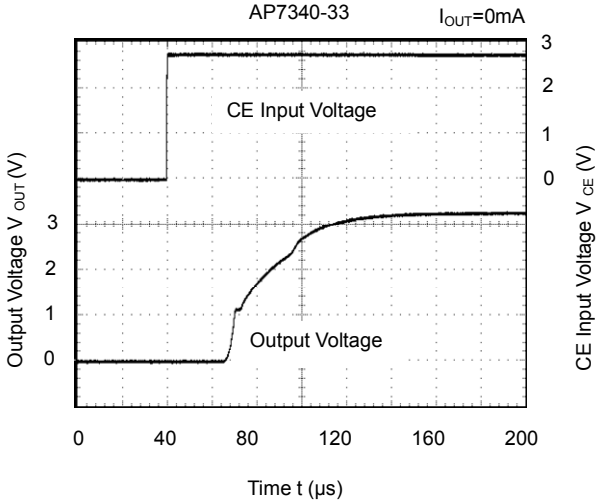
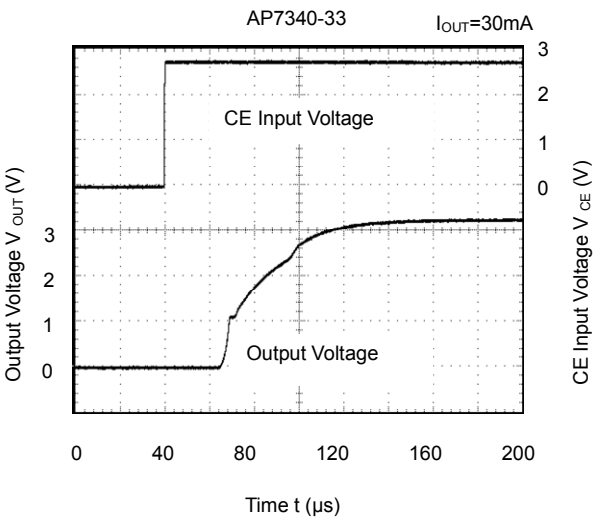
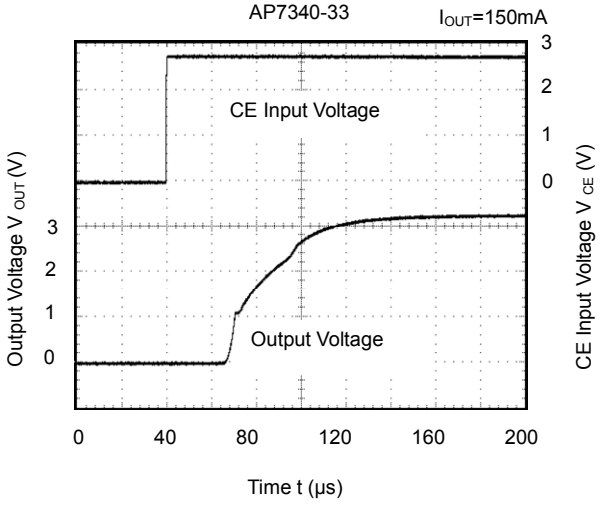




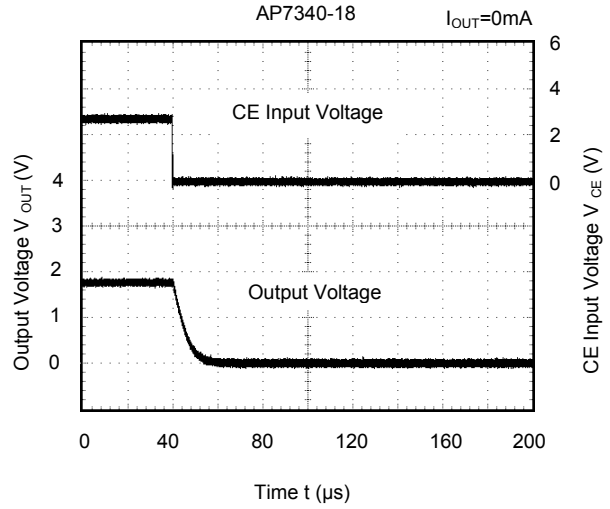


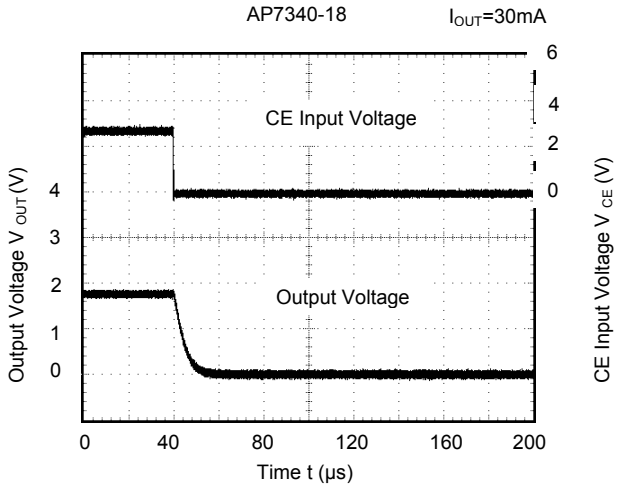


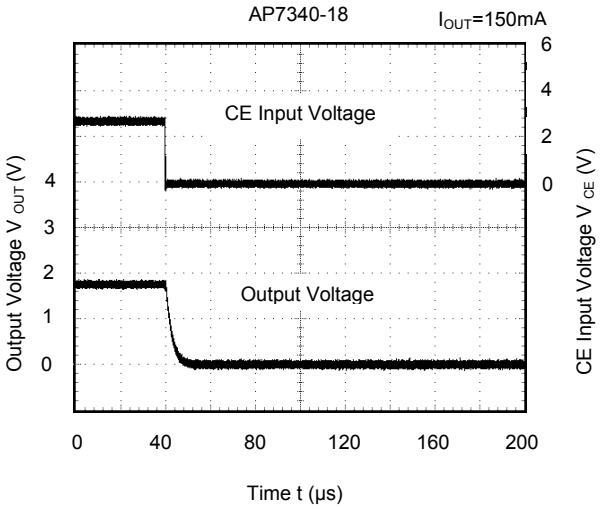


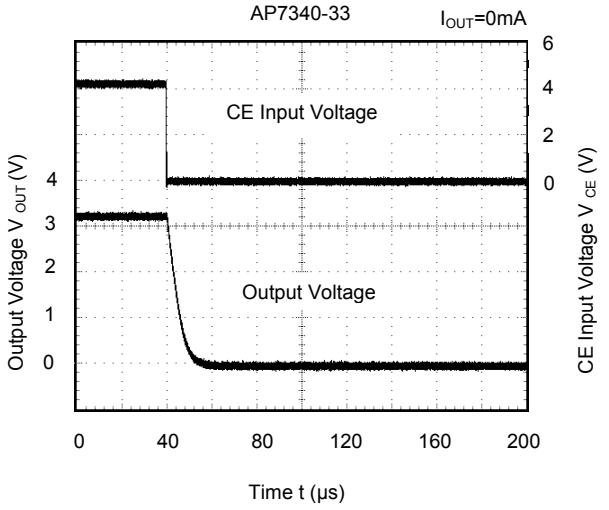


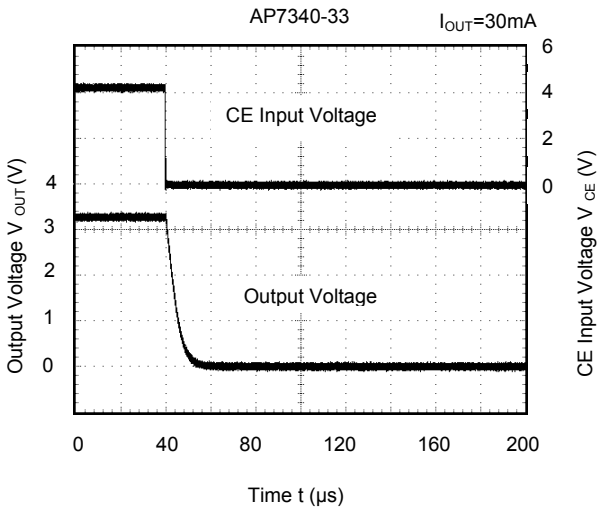
Typical Characteristics (cont.)

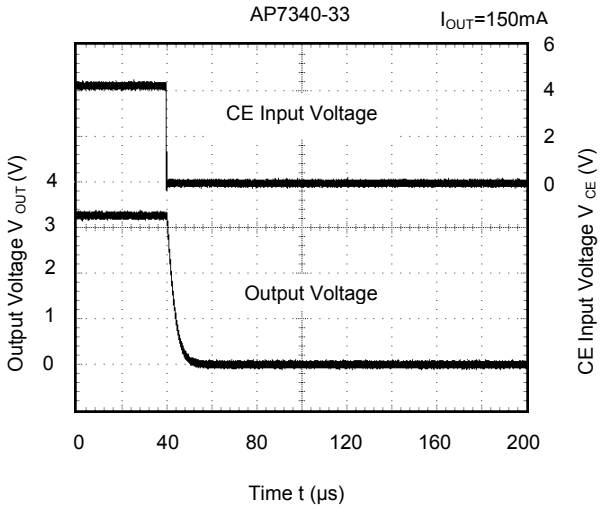












Application Information

Output Capacitor

An output capacitor (C_{OUT}) is needed to improve transient response and maintain stability. The AP7340 is stable with very small ceramic output capacitors. The ESR (equivalent series resistance) and capacitance drives the selection. If the application has large load variations, it is recommended to utilize low-ESR bulk capacitors. It is recommended to place ceramic capacitors as close as possible to the load and the ground pin and care should be taken to reduce the impedance in the layout.

Input Capacitor

To prevent the input voltage from dropping during load steps it is recommended to utilize an input capacitor (C_{IN}). A minimum 0.47µF ceramic capacitor is recommended between V_{IN} and GND pins to decouple input power supply glitch. This input capacitor must be located as close as possible to the device to assure input stability and reduce noise. For PCB layout, a wide copper trace is required for both V_{IN} and GND pins.

Enable Control

The AP7340 is turned on by setting the EN pin high, and is turned off by pulling it low. If this feature is not used, the EN pin should be tied to V_{IN} pin to keep the regulator output on at all time. To ensure proper operation, the signal source used to drive the EN pin must be able to swing above and below the specified turn-on/off voltage thresholds listed in the Electrical Characteristics section.

Short Circuit Protection

When V_{OUT} pin is short-circuit to GND, short circuit protection will be triggered and clamp the output current to approximately 60mA. This feature protects the regulator from over-current and damage due to overheating.

Layout Considerations

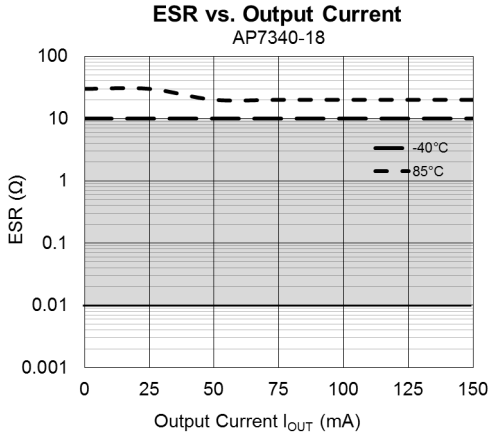
For good ground loop and stability, the input and output capacitors should be located close to the input, output, and ground pins of the device. The regulator ground pin should be connected to the external circuit ground to reduce voltage drop caused by trace impedance. Ground plane is generally used to reduce trace impedance. Wide trace should be used for large current paths from V_{IN} to V_{OUT}, and load circuit.

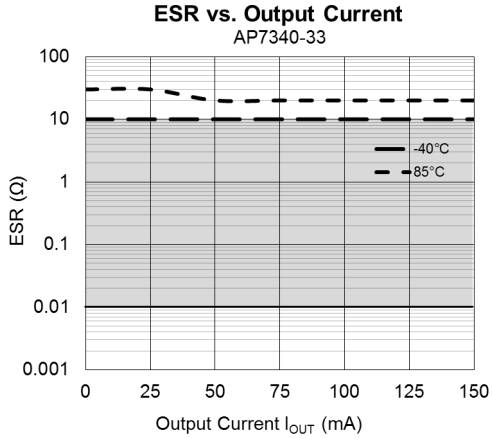
ESR vs. Output Current

Ceramic type output capacitor is recommended for this series; however, the other output capacitors with low ESR also can be used. The relations between I_{OUT} (Output Current) and ESR of an output capacitor are shown below. The stable region is marked as the hatched area in the graph.

Measurement conditions:

Frequency Band : 10Hz to 2MHz, Temperature : -40°C to +85°C





Ordering Information

AP7340X - XX FS4 - 7

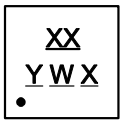
Output Discharge	Output	Package	Packing
Blank : Non Discharge D : Discharge	11 : 1.1V 12 : 1.2V 15 : 1.5V 18 : 1.8V 185 : 1.85V 22 : 2.2V 23 : 2.3V 25 : 2.5V 26 : 2.6V 28 : 2.8V 285 : 2.85V 30 : 3.0V 31 : 3.1V 32 : 3.2V 33 : 3.3V 36 : 3.6V	FS4 : X2-DFN1010-4	7 : Tape & Reel

Part Number	Package Code	Packaging	7" Tape and Reel	
			Quantity	Part Number Suffix
AP7340-XXFS4-7	FS4	X2-DFN1010-4	5000/Tape & Reel	-7
AP7340D-XXFS4-7	FS4	X2-DFN1010-4	5000/Tape & Reel	-7

Marking Information

X2-DFN1010-4

(Top View)



XX : Identification Code
Y : Year : 0~9
W : Week : A~Z : 1~26 week;
a~z : 27~52 week; z represents 52 and 53 week
X : A~Z : Internal code

Part Number	Package	Identification Code
AP7340-11FS4-7	X2-DFN1010-4	EA
AP7340-12FS4-7	X2-DFN1010-4	CH
AP7340-15FS4-7	X2-DFN1010-4	CJ
AP7340-18FS4-7	X2-DFN1010-4	CK
AP7340-185FS4-7	X2-DFN1010-4	EV
AP7340-22FS4-7	X2-DFN1010-4	CQ
AP7340-23FS4-7	X2-DFN1010-4	CV
AP7340-25FS4-7	X2-DFN1010-4	CM
AP7340-26FS4-7	X2-DFN1010-4	S2
AP7340-28FS4-7	X2-DFN1010-4	CN
AP7340-285FS4-7	X2-DFN1010-4	EW
AP7340-30FS4-7	X2-DFN1010-4	EX
AP7340-31FS4-7	X2-DFN1010-4	EY
AP7340-32FS4-7	X2-DFN1010-4	EZ
AP7340-33FS4-7	X2-DFN1010-4	CP
AP7340-36FS4-7	X2-DFN1010-4	EB
AP7340D-11FS4-7	X2-DFN1010-4	EC
AP7340D-12FS4-7	X2-DFN1010-4	DG

Marking Information (cont.)

X2-DFN1010-4

(Top View)

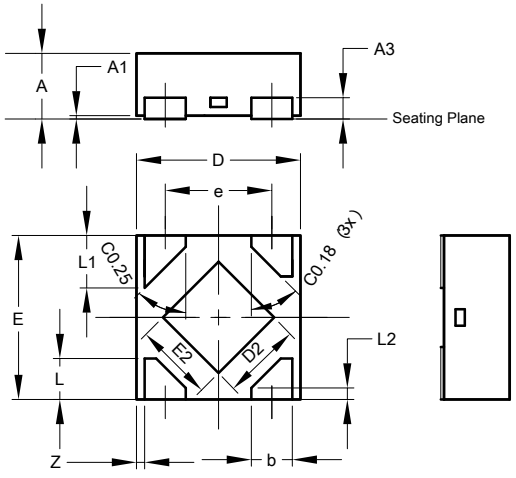
XX : Identification Code
Y : Year : 0~9
W : Week : A~Z : 1~26 week;
a~z : 27~52 week; z represents
52 and 53 week
X : A~Z : Internal code

AP7340D-15FS4-7	X2-DFN1010-4	DH
AP7340D-18FS4-7	X2-DFN1010-4	DJ
AP7340D-185FS4-7	X2-DFN1010-4	DV
AP7340D-22FS4-7	X2-DFN1010-4	D8
AP7340D-23FS4-7	X2-DFN1010-4	D9
AP7340D-25FS4-7	X2-DFN1010-4	DK
AP7340D-26FS4-7	X2-DFN1010-4	S3
AP7340D-28FS4-7	X2-DFN1010-4	DM
AP7340D-285FS4-7	X2-DFN1010-4	DW
AP7340D-30FS4-7	X2-DFN1010-4	DX
AP7340D-31FS4-7	X2-DFN1010-4	DY
AP7340D-32FS4-7	X2-DFN1010-4	DZ
AP7340D-33FS4-7	X2-DFN1010-4	DN
AP7340D-36FS4-7	X2-DFN1010-4	ED

Package Outline Dimensions (All dimensions in mm.)

Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for latest version.

Package Type: X2-DFN1010-4

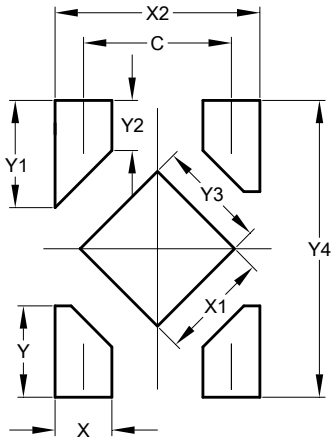


X2-DFN1010-4			
Dim	**Min**	**Max**	**Typ**
A	-	0.40	0.39
A1	0.00	0.05	0.02
A3	-	-	0.13
b	0.20	0.30	0.25
D	0.95	1.05	1.00
D2	0.43	0.53	0.48
E	0.95	1.05	1.00
E2	0.43	0.53	0.48
e	-	-	0.65
L	0.20	0.30	0.25
L1	0.27	0.37	0.32
L2	0.02	0.12	0.07
Z	-	-	0.050
All Dimensions in mm			

Suggested Pad Layout

Please see AP02001 at http://www.diodes.com/datasheets/ap02001.pdf for the latest version.

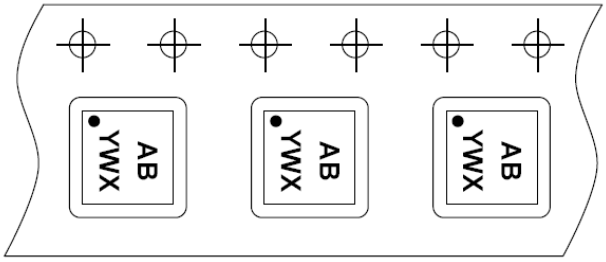
Package Type: X2-DFN1010-4

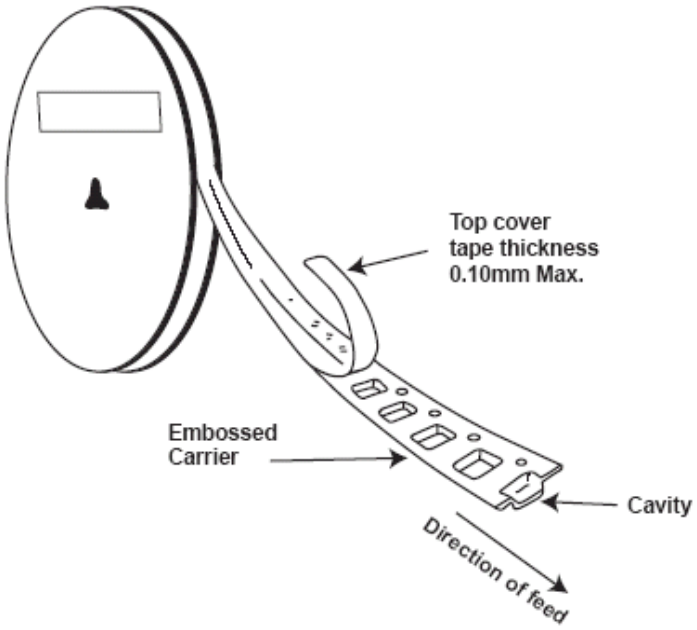


Dimensions	Value (in mm)
C	0.650
X	0.250
X1	0.480
X2	0.900
Y	0.400
Y1	0.470
Y2	0.220
Y3	0.480

Tape Orientation

For X2-DFN1010-4





Note: 12. The taping orientation of the other package type can be found on our website at http://www.diodes.com/datasheets/ap02007.pdf

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