THE AP7344 IS NOT RECOMMENDED FOR NEW DESIGNS.
PLEASE USE THE AP7345D.

Lead-free Green

AP7344

DUAL 300mA HIGH PSRR LOW-NOISE LDO WITH ENABLE

Description

The AP7344 is a Dual 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.

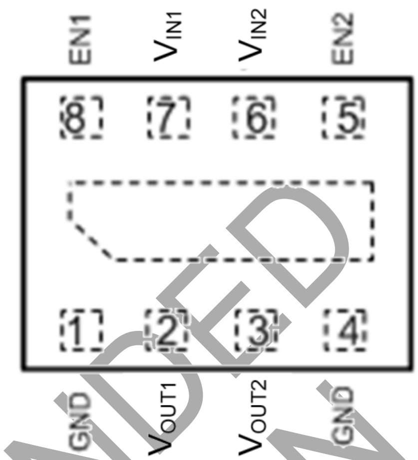
Each of regulators includes a voltage reference, error amplifier, current limit circuit and an enable input to turn on/ off output. With the integrated resistor network fixed output voltage versions can be delivered.

With its low power consumption and line and load transient response, the AP7344 is well suited for low power handheld communication equipment.

The AP7344 is packaged in X2-DFN1612-8 package and allows for smallest footprint and dense PCB layout.

Pin Assignments

(Top View)



X2-DFN1612-8

Features

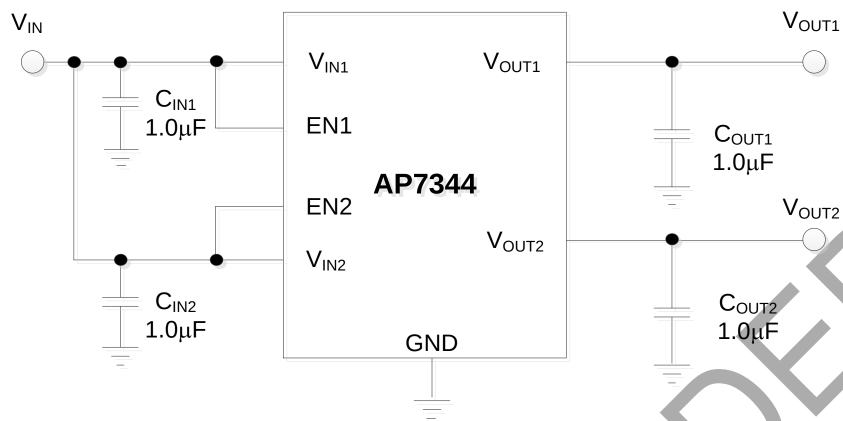
- Low V_{IN} and Wide V_{IN} Range: 1.7V to 5.25V
- Guarantee Output Current: 300mA
- V_{OUT} Accuracy ±1%
- Ripple Rejection: 75dB at 1kHz
- Low Output Noise: 60µVrms from 10Hz to 100kHz
- Quiescent Current as Low as 50µA
- V_{OUT} Fixed 1.2V to 3.6V
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free, Green Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative.
https://www.diodes.com/quality/product-definitions/**

Applications

- Smart phones/Tablets
- RF supplies
- Cameras
- Portable videos
- Portable media players
- Wireless adapters
- Wireless communication

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ 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.

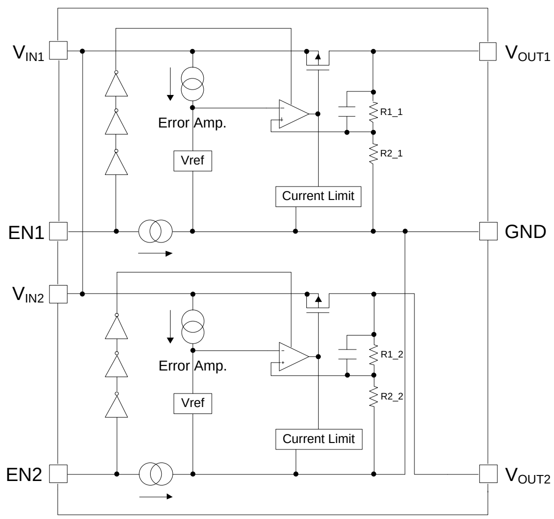
Typical Applications Circuit



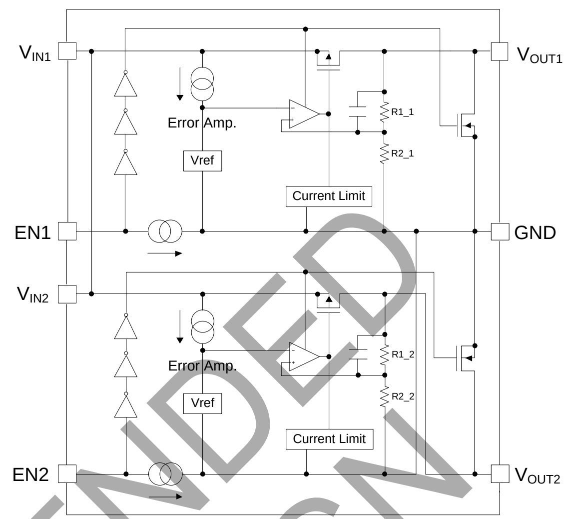
Pin Descriptions

Pin Name	Pin Number	Function
GND	1, 4	Ground
V_{OUT1}	2	Channel 1 Output Voltage pin
V_{OUT2}	3	Channel 2 Output Voltage pin
EN2	5	Chanel 2 Enable pin. This pin should be driven either high or low and must not be floating. Driving this pin high enables channel 2 output, while pulling it low puts Chanel 2 regulator into shutdown mode.
V_{IN2}	6	Input Voltage pin
V_{IN1}	7	Input Voltage pin
EN1	8	Chanel 1 Enable pin. This pin should be driven either high or low and must not be floating. Driving this pin high enables channel 1 output, while pulling it low puts Chanel 1 regulator into shutdown mode.
—	Thermal Pad	In PCB layout, it is preferred 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



AP7344 (No Discharge)



AP7344 (With Discharge)

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

Symbol	Parameter	Rating	Unit
V_{IN}	Input Voltage	6.0	V
V_{EN}	Input Voltage at EN Pins	6.0	V
V_{OUT}	Output Voltage	-0.3 to V_{IN} +0.3	V
I_{OUT}	Output Current	400	mA
P_D	Power Dissipation	600	mW
T_A	Operating Ambient Temperature	-40 to +85	°C
T_{STG}	Storage Temperature	-55 to +125	°C

Note: 4. Stresses greater than those listed under *Absolute Maximum Ratings* can cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to *Absolute Maximum Ratings* for extended periods can affect device reliability.

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

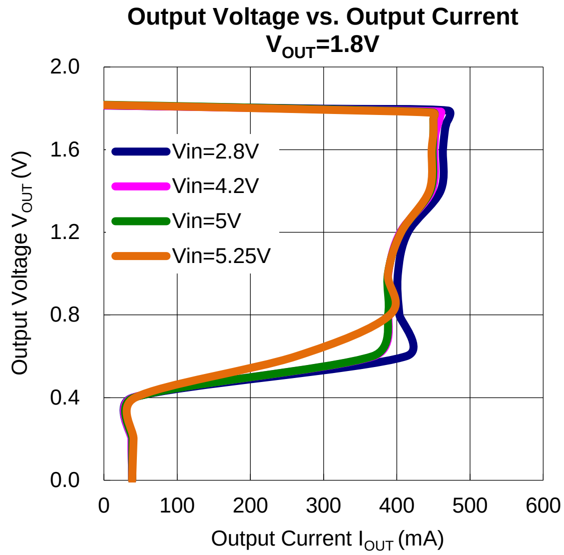
Symbol	Parameter	Min	Max	Unit
V_{IN}	Input Voltage	1.7	5.25	V
I_{OUT}	Output Current	0	300	mA
T_A	Operating Ambient Temperature	-40	+85	°C

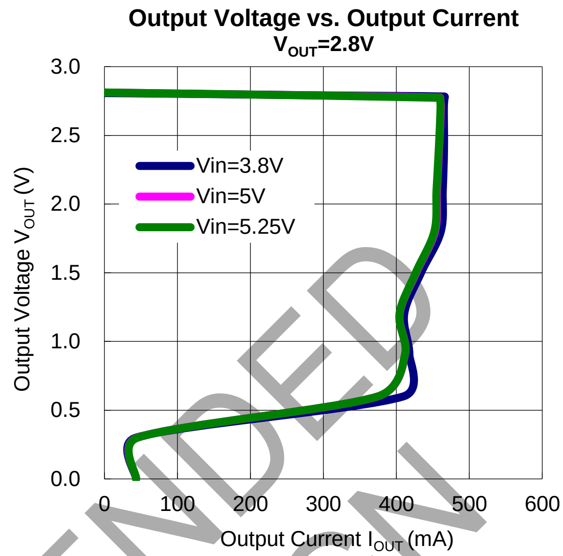
Electrical Characteristics (@T_A = +25°C, V_{IN} = V_{OUT}+1V (V_{OUT} > 1.5V), V_{IN} = 2.5V (V_{OUT} ≤ 1.5V), I_{OUT} = 1mA, C_{IN} = C_{OUT} = 1.0µF, unless otherwise specified.)

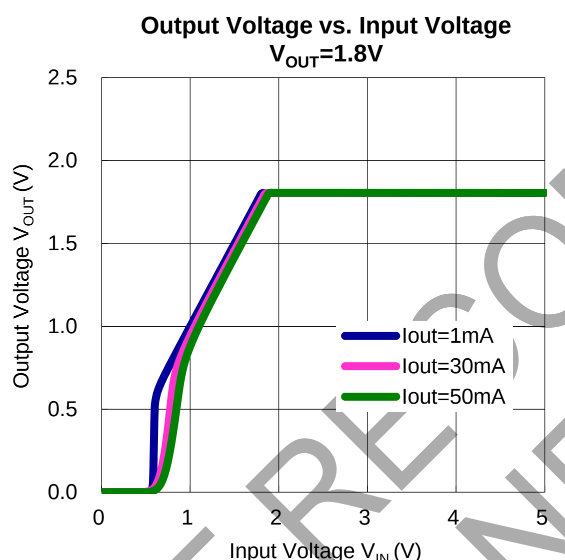
Parameter	Conditions		Min	Typ	Max	Unit
Input Voltage	T_A = -40°C to +85°C		1.7	—	5.25	V
Output Voltage Accuracy (Note 5)	V_{IN} = ($V_{OUT-Nom}$+1.0V) to 5.25V I_{OUT} = 1mA to 300mA	T_A = +25°C	-1	—	1	%
		T_A = -40°C to +85°C	-1.5	—	1.5	
Line Regulation ($\Delta V_{OUT}/\Delta V_{IN}/V_{OUT}$)	V_{IN} = ($V_{OUT-Nom}$+1.0V) to 5.25V, I_{OUT} = 1.0mA		—	0.02	0.1	%/V
Load Regulation ($\Delta V_{OUT}/\Delta I_{OUT}$)	V_{IN} = $V_{OUT-Nom}$+1.0V, I_{OUT} = 1mA to 300mA		—	15	30	mV
Quiescent Current (Note 6)	Set EN1 High, Set EN2 Low, or Set EN2 High, Set EN1 Low, No Load		—	50	70	µA
	Set EN1/EN2 High, No Load		—	100	140	µA
$I_{STANDBY}$	Set EN1/EN2 Low, No Load		—	0.1	1.0	µA
Output Current	—		300	—	—	mA
Foldback Short Current (Note 7)	V_{OUT} short to ground		—	55	—	mA
PSRR (Note 8)	V_{IN} = (V_{OUT}+1V) V_{DC} + 0.2Vp-pAC V_{OUT} ≥ 1.8V, I_{OUT} = 30mA	f = 1kHz	—	75	—	dB
Output Noise Voltage (Notes 8 & 9)	BW = 10Hz to 100kHz, I_{OUT} = 30mA		—	60	—	µVrms
Dropout Voltage (Note 10)	I_{OUT} = 300mA	V_{OUT} ≤ 1.2V	—	0.48	0.59	V
		1.2V < V_{OUT} ≤ 1.4V	—	0.39	0.50	
		1.4V < V_{OUT} ≤ 1.7V	—	0.35	0.44	
		1.7V < V_{OUT} ≤ 2.1V	—	0.30	0.39	
		2.1V < V_{OUT} ≤ 2.5V	—	0.26	0.34	
		2.5V < V_{OUT} ≤ 3.0V	—	0.25	0.30	
		3.0V < V_{OUT} ≤ 3.6V	—	0.22	0.29	
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} = 0V, 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 11)	V_{IN} = 4.0V, V_{EN} = 0V (Disabled)	D Version, Chanel 1 & 2	—	50	—	Ω

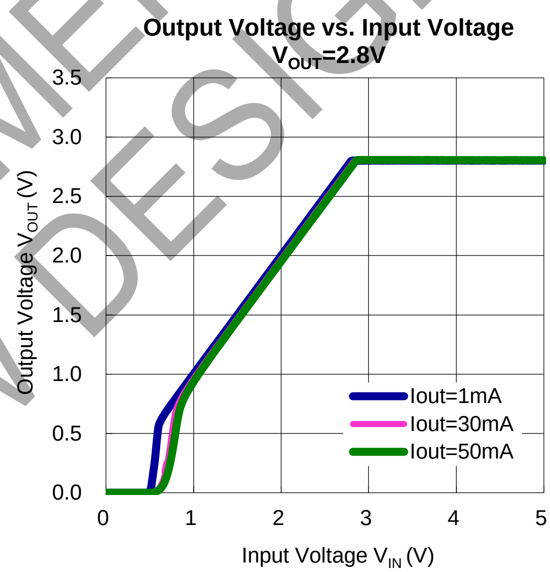
Notes:
5. Potential multiple grades based on following output voltage accuracy.
6. Quiescent current is defined here is the difference in current between the input and the output.
7. Short circuit current is measured with V_{OUT} pulled to GND.
8. This specification is guaranteed by design.
9. To make sure lowest environment noise minimizes the influence on noise measurement.
10. Dropout voltage is the voltage difference between the input and the output at which the output voltage drops 2% below its nominal value.
11. AP7344 has 2 options for output, built-in discharge and non-discharge

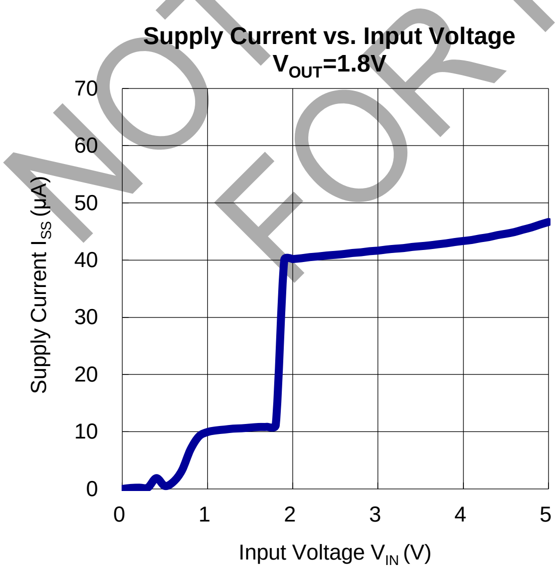
Performance Characteristics

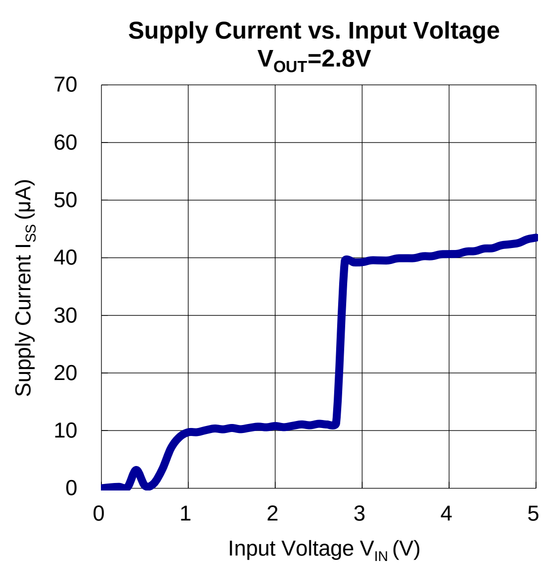






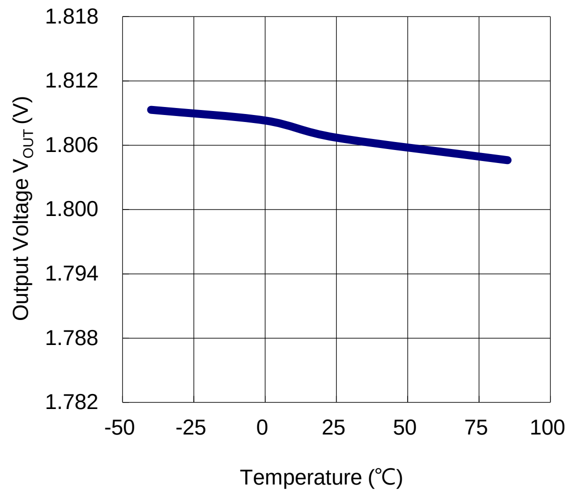




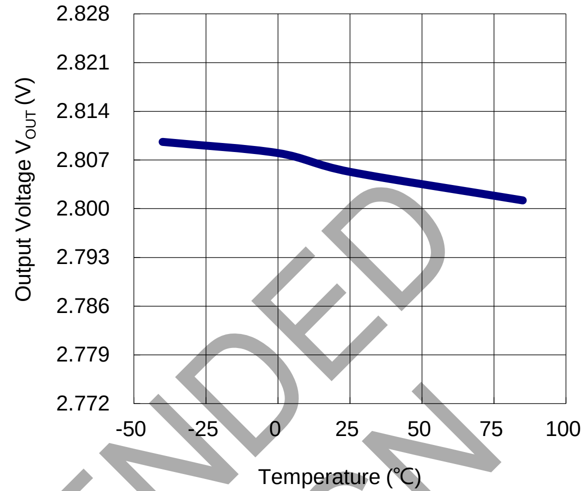


Performance Characteristics (continued)

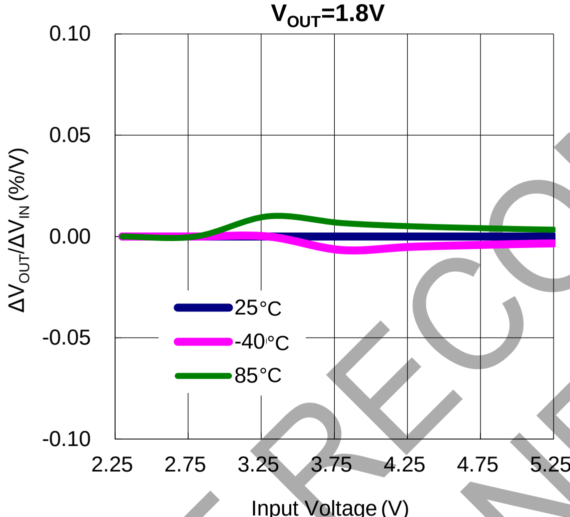
Output Voltage vs.Temperature
V_{OUT}=1.8V



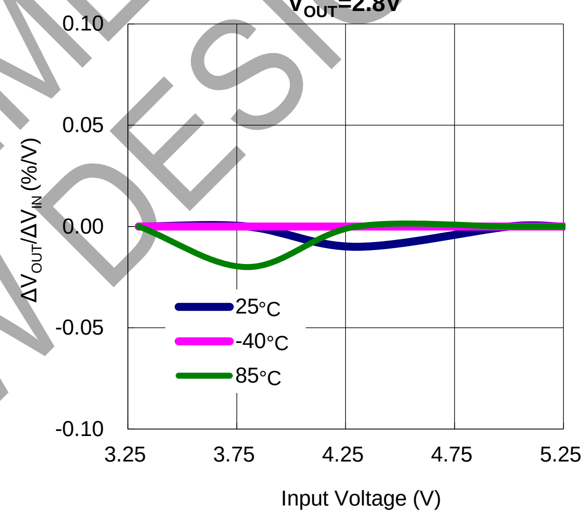
Output Voltage vs.Temperature
V_{OUT}=2.8V



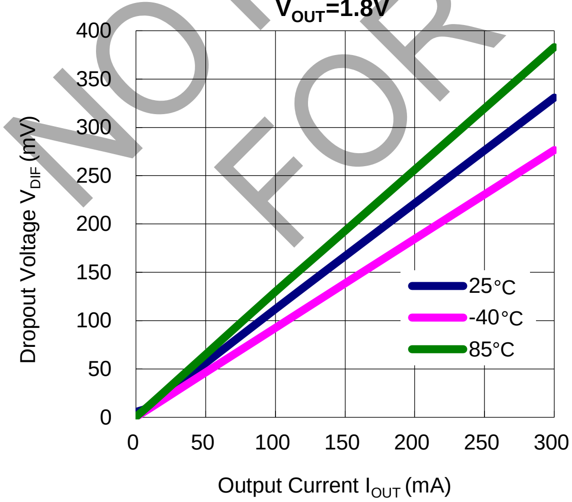
Line Regulation vs. Input Voltage
V_{OUT}=1.8V



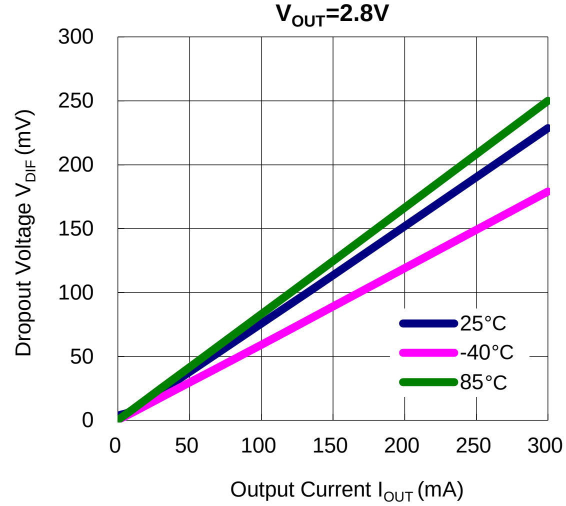
Line Regulation vs. Input Voltage
V_{OUT}=2.8V



Dropout Voltage vs. Output Current
V_{OUT}=1.8V

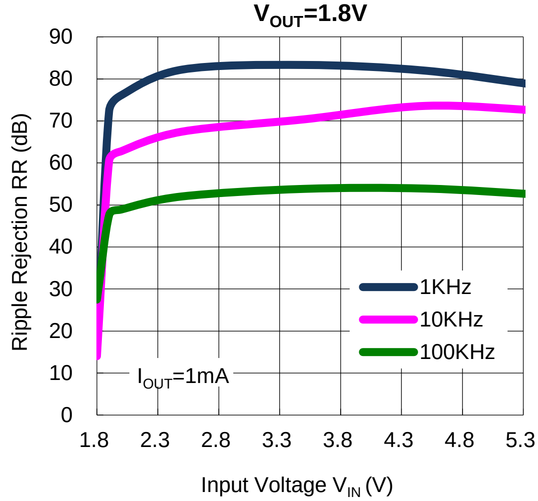


Dropout Voltage vs. Output Current
V_{OUT}=2.8V

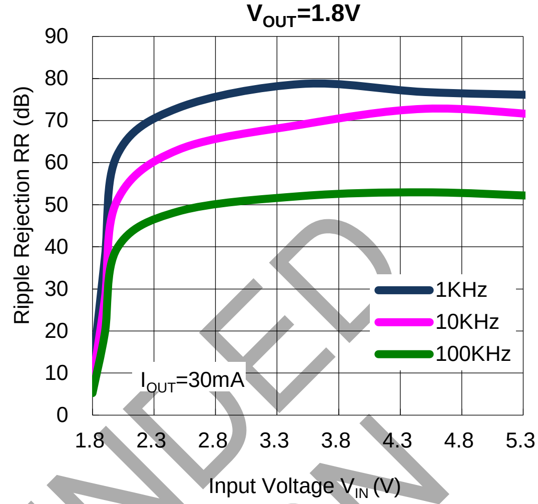


Performance Characteristics (continued)

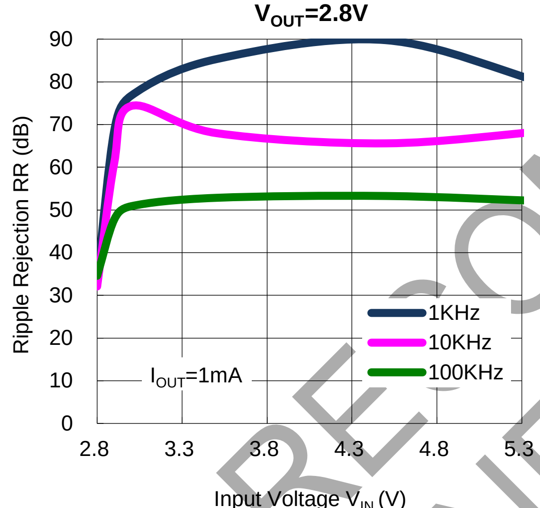
Ripple Rejection vs. Input Voltage
V_{OUT}=1.8V



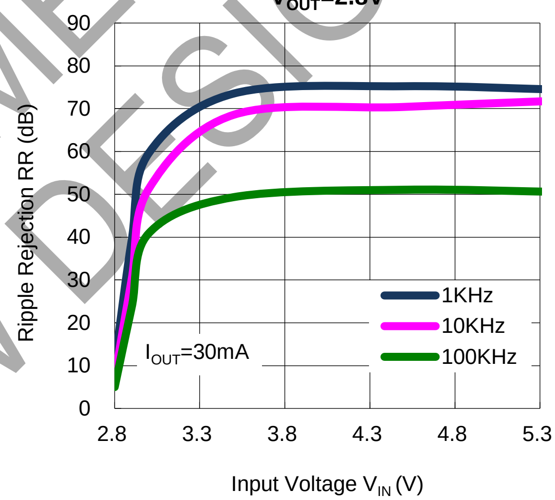
Ripple Rejection vs. Input Voltage
V_{OUT}=1.8V



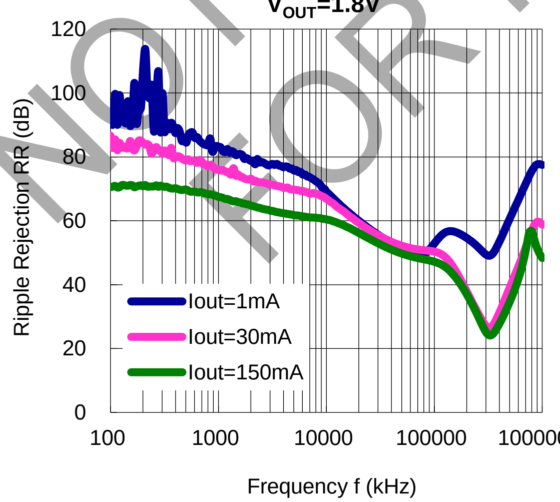
Ripple Rejection vs. Input Voltage
V_{OUT}=2.8V



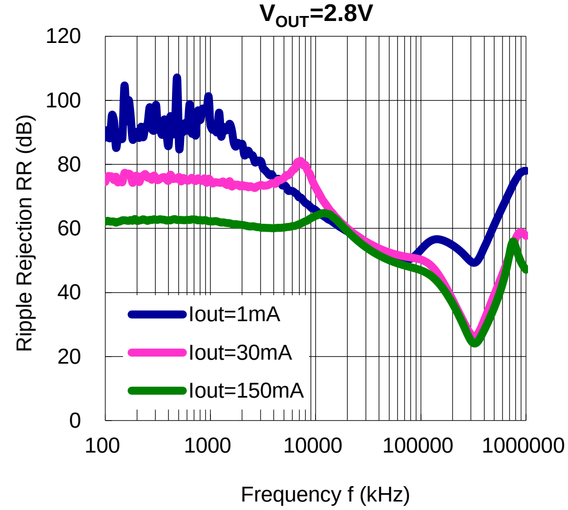
Ripple Rejection vs. Input Voltage
V_{OUT}=2.8V



Ripple Rejection vs. Frequency
V_{OUT}=1.8V

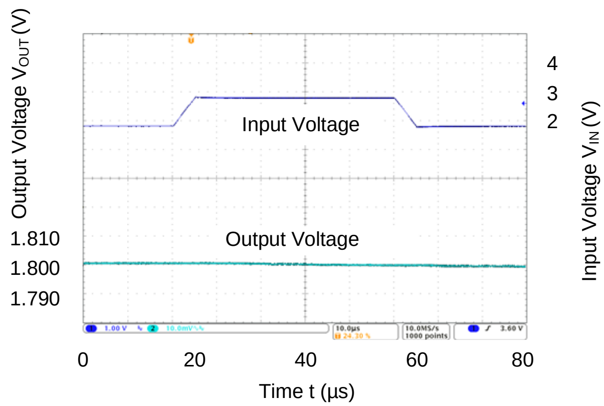


Ripple Rejection vs. Frequency
V_{OUT}=2.8V

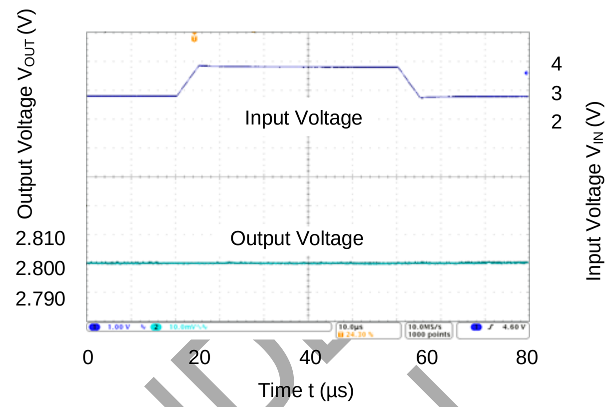


Performance Characteristics (continued)

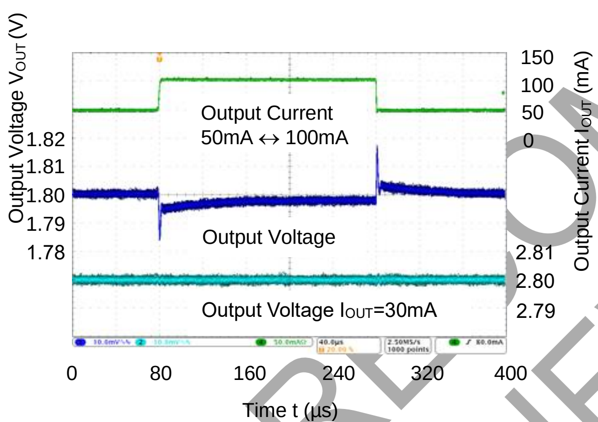
Line Transient Response Waveforms
V_{OUT}=1.8V



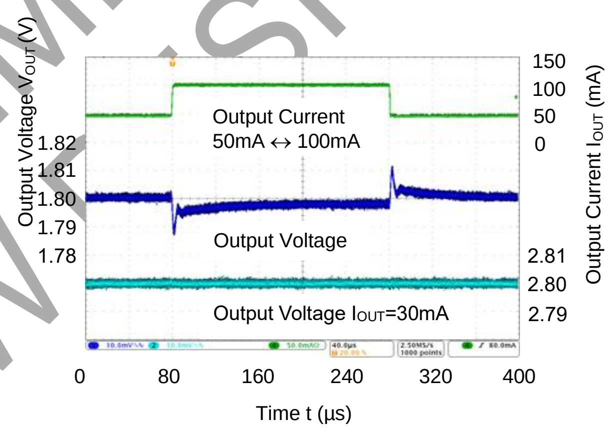
Line Transient Response Waveforms
V_{OUT}=2.8V



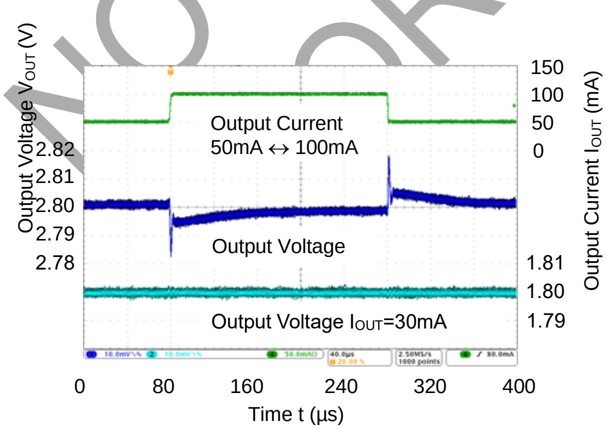
Load Transient Response Waveforms
V_{OUT}=1.8V, C_{OUT}=1µF



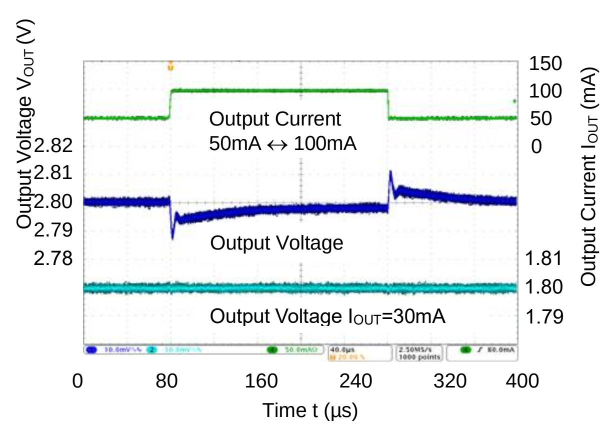
Load Transient Response Waveforms
V_{OUT}=1.8V, C_{OUT}=4.7µF



Load Transient Response Waveforms
V_{OUT}=2.8V, C_{OUT}=1µF

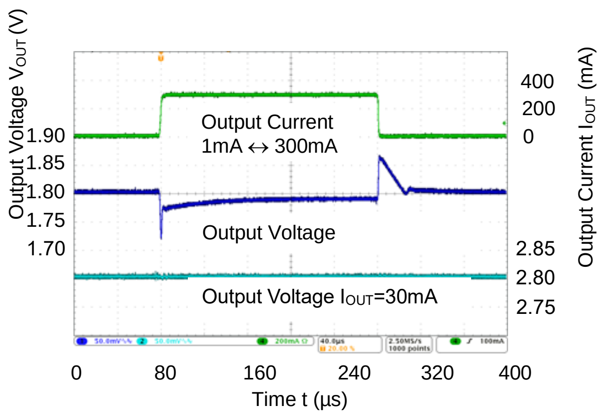


Load Transient Response Waveforms
V_{OUT}=2.8V, C_{OUT}=4.7µF

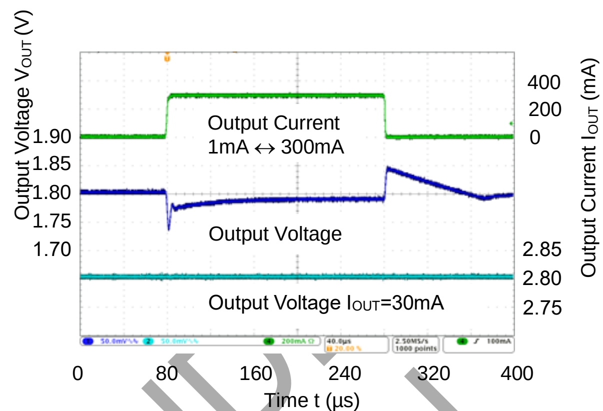


Performance Characteristics (continued)

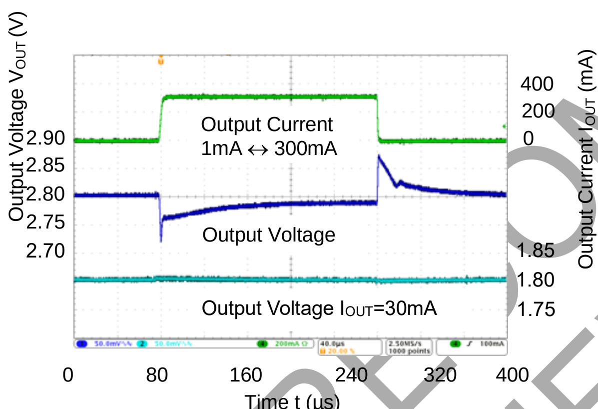
Load Transient Response Waveforms
V_{OUT}=1.8V, C_{OUT}=1μF



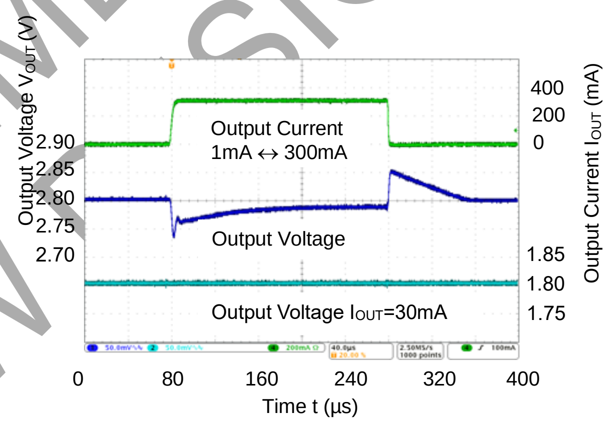
Load Transient Response Waveforms
V_{OUT}=1.8V, C_{OUT}=4.7μF



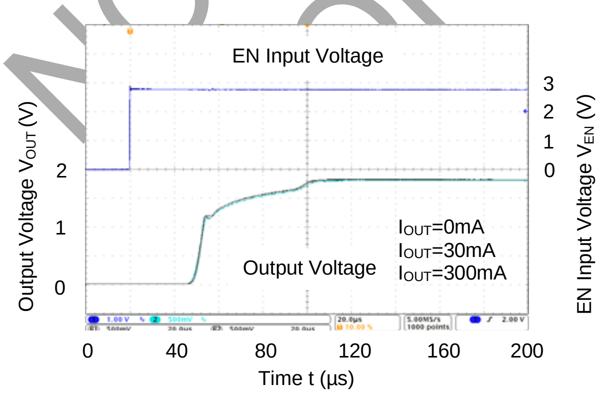
Load Transient Response Waveforms
V_{OUT}=2.8V, C_{OUT}=1μF



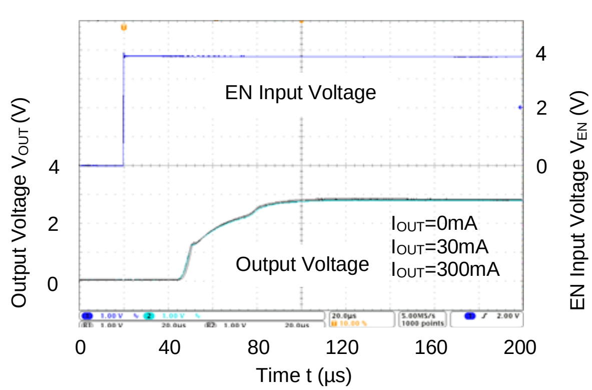
Load Transient Response Waveforms
V_{OUT}=2.8V, C_{OUT}=4.7μF



Turn On Waveforms
V_{OUT}=1.8V



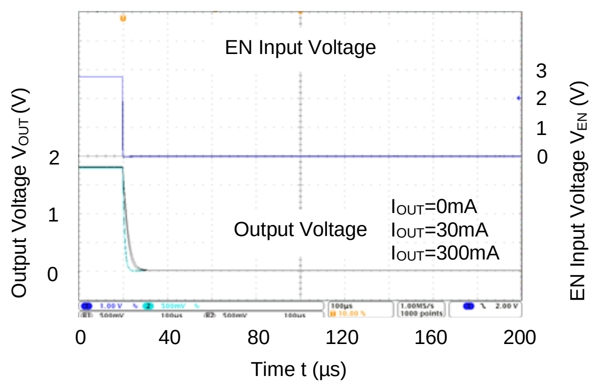
Turn On Waveforms
V_{OUT}=2.8V



Performance Characteristics (continued)

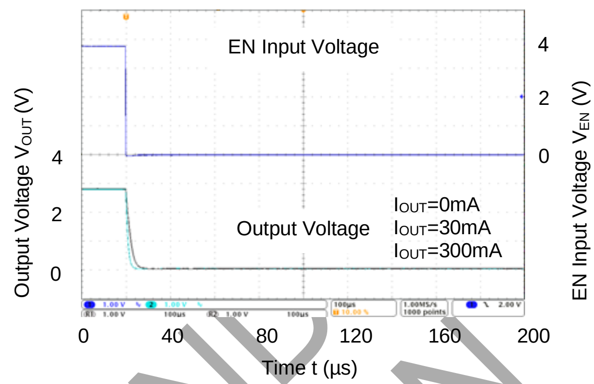
Turn Off Waveforms

V_{OUT}=1.8V



Turn Off Waveforms

V_{OUT}=2.8V



Application Information

Output Capacitor

An output capacitor (C_{OUT}) is needed to improve transient response and maintain stability. The AP7344 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 GND pins 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 ensure input stability and reduce noise. For PCB layout, a wide copper trace is required for both V_{IN} and GND pins.

Enable Control

The AP7344 is turned on by setting the EN pins high, and is turned off by pulling it low. If this feature is not used, the EN pins should be tied to V_{IN} pins to keep the regulator output on at all time. To ensure proper operation, the signal source used to drive the EN pins 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} pins are short-circuit to GND, short-circuit protection will be triggered and clamp the output current to approximately 60mA. This feature protects the regulator from overcurrent and damage due to overheating.

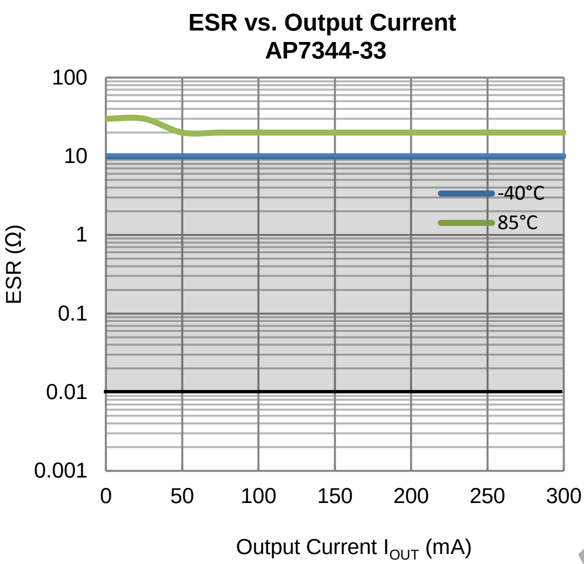
Layout Considerations

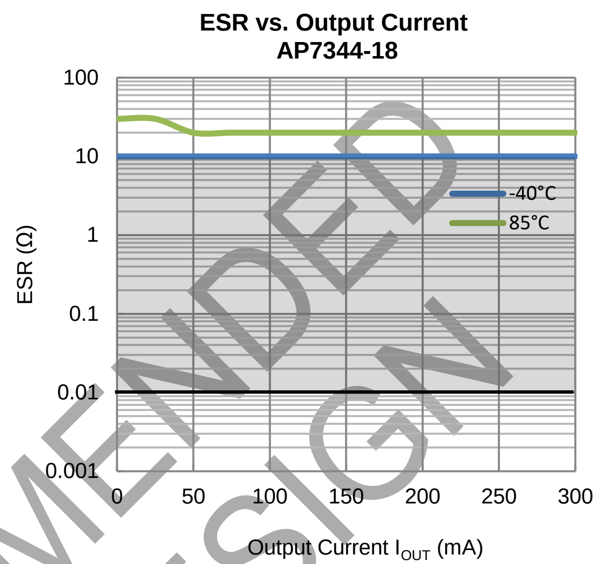
For good ground loop and stability, the input and output capacitors should be located close to the input, output, and GND pins of the device. The regulator GND pins should be connected to the external circuit ground to reduce voltage drop caused by trace impedance. Ground plane is generally used to reduce 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

AP7344X - XXXXXX RH4 - 7

Output Discharge	CH1/CH2 Output Voltage		Package	Packing
Blank : Non-discharge	CH1	CH2	RH4 : X2-DFN1612-8	7 : Tape & Reel
D : Output Discharge	12 : 1.2V	12 : 1.2V		
	15 : 1.5V	15 : 1.5V		
	18 : 1.8V	18 : 1.8V		
	25 : 2.5V	25 : 2.5V		
	28 : 2.8V	28 : 2.8V		
	285 : 2.85V	285 : 2.85V		
	30 : 3.0V	30 : 3.0V		
	33 : 3.3V	33 : 3.3V		
	36 : 3.6V			

Part Number	Part Number Suffix	Package Code	Package	Packing	
				Qty.	Carrier
AP7344-XXXXRH4-7	-7	RH4	X2-DFN1612-8	5000	7" Tape and Reel
AP7344D-XXXXXXRH4-7	-7	RH4	X2-DFN1612-8	5000	7" Tape and Reel

Marking Information

(1) X2-DFN1612-8

(Top View)

XXX
Y W X

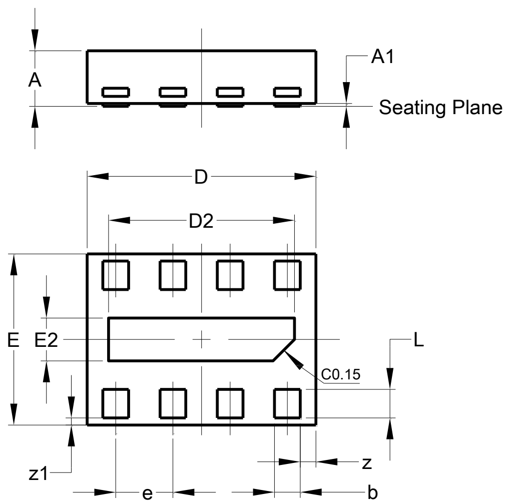
XXX : Identification Code
Y : Year : 0 to 9
W : Week : A to Z : week 1 to 26;
a to z : week 27 to 52; z represents
week 52 and 53
X : Internal Code

Part Number	V_{OUT1}/V_{OUT2}	Package	Identification Code
AP7344-3028RH4-7	3.0V/2.8V	X2-DFN1612-8	DAA
AP7344-3328RH4-7	3.3V/2.8V	X2-DFN1612-8	DAB
AP7344-3318RH4-7	3.3V/1.8V	X2-DFN1612-8	DAC
AP7344D-1218RH4-7	1.2V/1.8V	X2-DFN1612-8	DAD
AP7344D-1528RH4-7	1.5V/2.8V	X2-DFN1612-8	DAE
AP7344D-1812RH4-7	1.8V/1.2V	X2-DFN1612-8	DAF
AP7344D-1815RH4-7	1.8V/1.5V	X2-DFN1612-8	DAG
AP7344D-1818RH4-7	1.8V/1.8V	X2-DFN1612-8	DAH
AP7344D-1828RH4-7	1.8V/2.8V	X2-DFN1612-8	DAJ
AP7344D-1833RH4-7	1.8V/3.3V	X2-DFN1612-8	DAK
AP7344D-2518RH4-7	2.5V/1.8V	X2-DFN1612-8	DAM
AP7344D-2812RH4-7	2.8V/1.2V	X2-DFN1612-8	DAN
AP7344D-2818RH4-7	2.8V/1.8V	X2-DFN1612-8	DAP
AP7344D-2825RH4-7	2.8V/2.5V	X2-DFN1612-8	DAR
AP7344D-2833RH4-7	2.8V/3.3V	X2-DFN1612-8	DAS
AP7344D-2828RH4-7	2.8V/2.8V	X2-DFN1612-8	DAT
AP7344D-285285RH4-7	2.85V/2.85V	X2-DFN1612-8	DAU
AP7344D-3018RH4-7	3.0V/1.8V	X2-DFN1612-8	DAV
AP7344D-3028RH4-7	3.0V/2.8V	X2-DFN1612-8	DAW
AP7344D-3030RH4-7	3.0V/3.0V	X2-DFN1612-8	DAX
AP7344D-3318RH4-7	3.3V/1.8V	X2-DFN1612-8	DAY
AP7344D-3328RH4-7	3.3V/2.8V	X2-DFN1612-8	DAZ
AP7344D-3330RH4-7	3.3V/3.0V	X2-DFN1612-8	DA2
AP7344D-3333RH4-7	3.3V/3.3V	X2-DFN1612-8	DA3
AP7344D-3612RH4-7	3.6V/1.2V	X2-DFN1612-8	DA4

Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

(1) Package Type: X2-DFN1612-8

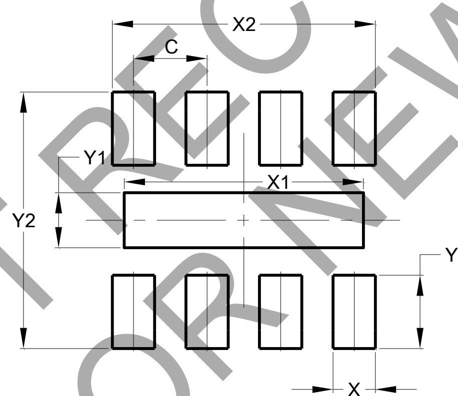


X2-DFN1612-8			
Dim	**Min**	**Max**	**Typ**
A	—	0.40	0.39
A1	0.00	0.05	0.02
b	0.13	0.23	0.18
D	1.55	1.65	1.60
D2	1.25	1.35	1.30
E	1.15	1.25	1.20
E2	0.25	0.35	0.30
e	—	—	0.40
L	0.15	0.25	0.20
z	—	—	0.11
z1	—	—	0.05
All Dimensions in mm			

Suggested Pad Layout

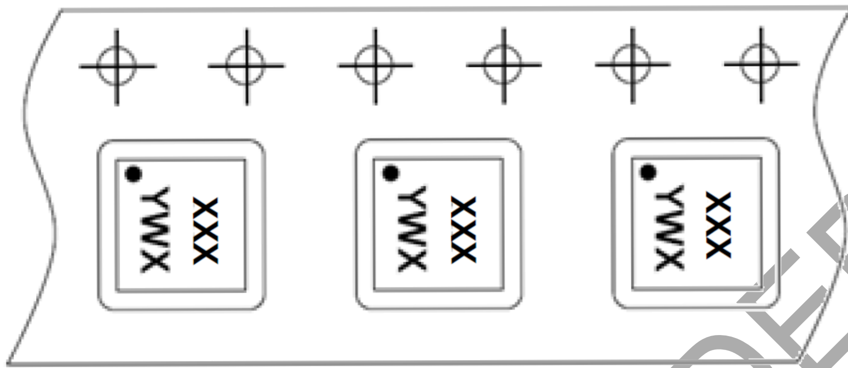
Please see http://www.diodes.com/package-outlines.html for the latest version.

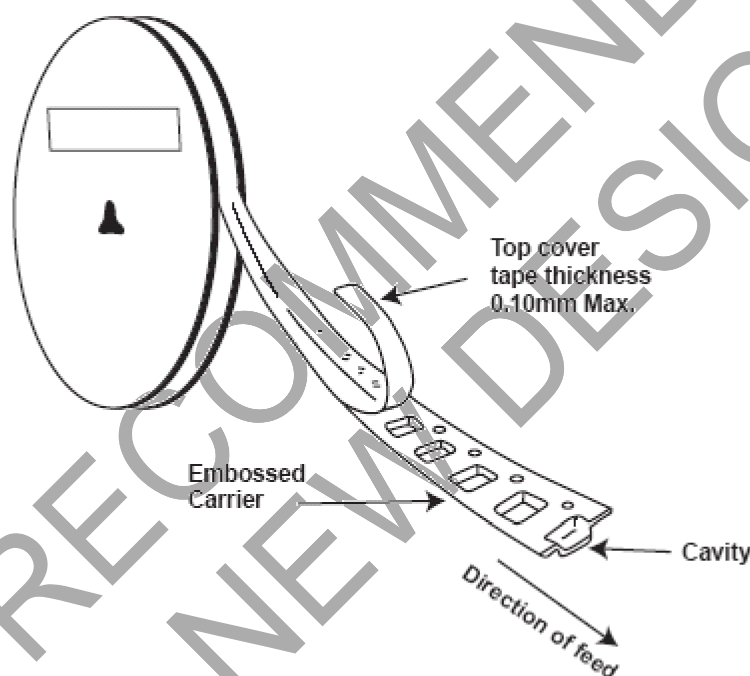
(1) Package Type: X2-DFN1612-8



Dimensions	Value (in mm)
C	0.400
X	0.230
X1	1.300
X2	1.430
Y	0.400
Y1	0.300
Y2	1.400

Tape Orientation





Note: 12. The taping orientation of the other package type can be found on our website at https://www.diodes.com/assets/Packaging-Support-Docs/ap02007.pdf.

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