AS1355

300mA, Triple LDO

1 General Description

The AS1355 is a high-performance triple CMOS low-dropout voltage regulator in a single QFN package. The efficient set of programmable power supplies is optimized to deliver the best compromise between quiescent current and regulator performance for mobile phones, PDAs, MP3 players, and other battery powered devices.

Stability is guaranteed with ceramic output capacitors of only 1µF (±20% – X5R) up to 4.7µF (±20% – X5R). The low equivalent series resistance (ESR) of these capacitors ensures low output impedance at high frequencies.

Regulation performance is excellent even under low dropout conditions, when the power transistor has to operate in linear mode.

The low-noise performance allows direct connection of noise sensitive circuits without additional filtering networks.

The AS1355 is available in a 16-pin QFN 3x3 package.

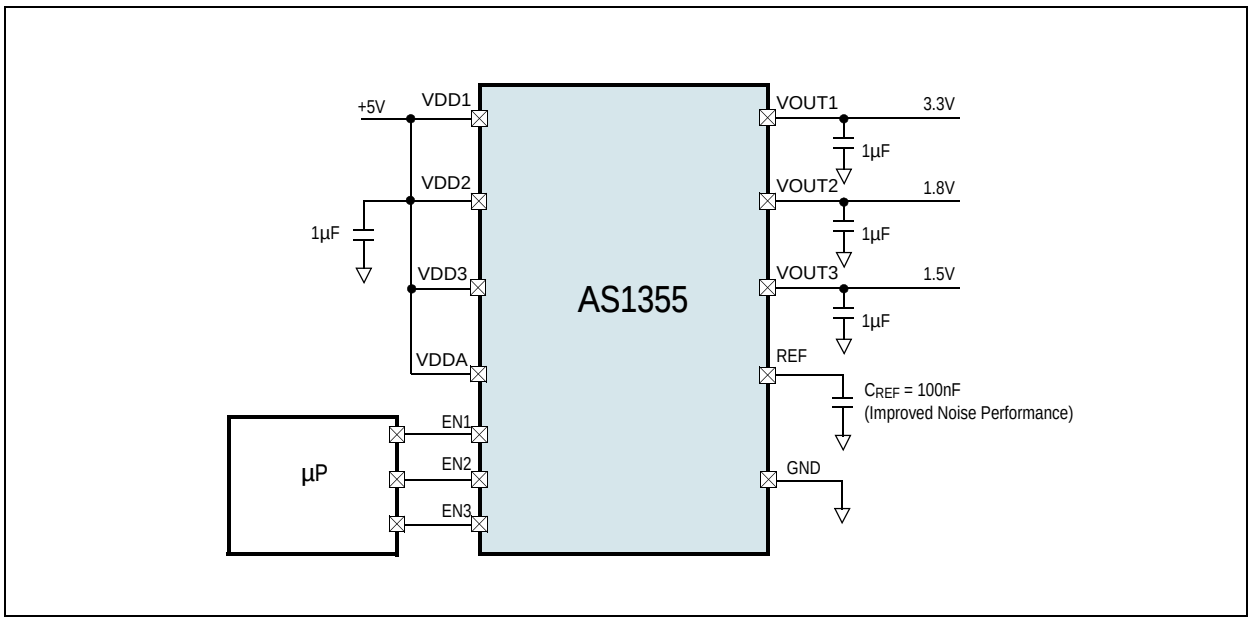
2 Key Features

- 3 Independent Voltage Regulators with Shutdown
- Output Current: 300mA each LDO
- Programmable Output Voltage Range: 1.25V to 3.6V in 50mV Steps
- Accuracy: ±1.0%
- PSRR: 70dB at 1kHz, 60dB at 100kHz
- Load Regulation: 3mV (0 to 300mA)
- Supply Range: 2.3V to 5.5V
- 0.1V Dropout Voltage @ Iload = 200mA
- Shutdown Current: 1µA
- Supply Current Without Load: 160µA
- Softstart for Low Inrush Current
- Stable with low ESR Ceramic Capacitors from 1µF to 4.7µF
- Low Noise: 40µV rms @10Hz to 100kHz Bandwidth
- Thermal Protection
- Over-Current Protection
- Temperature Range: -40°C to +85°C
- Packages:
  - 16-pin QFN 3x3
  - 16-pin TQFN 3x3

3 Applications

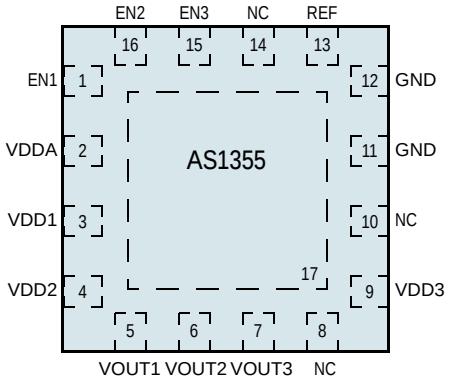
The AS1355 is ideal for cordless and mobile phones, MP3 players, CD and DVD players, PDAs, hand-held computers, digital cameras, and any other hand-held battery-powered device.

Figure 1. AS1355 - Typical Application Diagram



4 Pin Assignments

Figure 2. Pin Assignments (Top View)



4.1 Pin Descriptions

Table 1. Pin Descriptions

Pin Number	Pin Name	Description
1	EN1	Active-High Enable Input 1. Pull this pin to GND to disable the regulated output voltage V_{OUT1}.
2	VDDA	Analog Power Supply Voltage
3	VDD1	Unregulated Input Voltage 1
4	VDD2	Unregulated Input Voltage 2
5	VOUT1	Regulated Output Voltage 1
6	VOUT2	Regulated Output Voltage 2
7	VOUT3	Regulated Output Voltage 3
8	NC	Not Connected
9	VDD3	Unregulated Input Voltage 3
10	NC	Not Connected
11, 12	GND	Ground. **Note:** All GND pins must be connected together externally.
13	REF	Reference Voltage. **Note:** Connect to a 100nF capacitor during normal operation.
14	NC	Not Connected
15	EN3	Active-High Enable Input 3. Pull this pin to GND to disable the regulated output voltage V_{OUT3}.
16	EN2	Active-High Enable Input 2. Pull this pin to GND to disable the regulated output voltage V_{OUT2}.
17	NC	Exposed Pad. This pad is not connected internally, it can be connected to GND.

5 Absolute Maximum Ratings

Stresses beyond those listed in Table 2 may 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 in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Table 2. Absolute Maximum Ratings

Parameter	Min	Max	Units	Comments
Electrical Parameters				
VDDx, ENx to GND	-0.3	7	V	
VOUTx to GND	-0.3	5	V	
All other pins to GND	-0.3	V_{DD} + 0.3	V	
Electrostatic Discharge				
Electrostatic Discharge HBM	2		kV	Norm: MIL 883 E method 3015
Temperature Ranges and Storage Conditions				
Thermal Resistance Θ_{JA}		33	ºC/W	on PCB
Junction Temperature		+125	ºC	
Storage Temperature Range	-55	+125	ºC	
Package Body Temperature		+260	ºC	The reflow peak soldering temperature (body temperature) specified is in accordance with *IPC/ JEDEC J-STD-020"Moisture/Reflow Sensitivity Classification for Non-Hermetic Solid State Surface Mount Devices".*
Humidity non-condensing	5	85	%	
Moisture Sensitive Level	3			Represents a max. floor life time of 168h

6 Electrical Characteristics

V_{DD} = *4V,* C_{OUT} = *1µF, typical values are for* T_{AMB} = *25°C (unless otherwise specified*);

Table 3. Electrical Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{AMB}	Operating Temperature Range		-40		85	°C
V_{DD}	Supply Voltage Range		2.3		5.5	V
V_{OUT}	Output Voltage Range		1.25		3.6	V
R_{ON}	On Resistance			0.5		Ω
PSRR [1]	Power Supply Rejection Ratio	f = 1kHz, C_{REF} = 100nF		70		dB
		f = 100kHz, C_{REF} = 100nF		60		
I_{OFF}	Shut Down Current	ENx = Low, T_{AMB} = +25°C			1	µA
I_{VDD}	Supply Current	Without Load		160	240	µA
tset [1]	Output Voltage Settling Time	I_{LOAD} Switched from 0 to 100mA			50	µs
tstart [1]	Start-up Time [2]	C_{REF} = 100nF Pre-charged			300	µs
		C_{REF} = 0nF Uncharged		200		µs
		C_{REF} = 100nF Uncharged		15		ms
V_{OUT}	Output Voltage Tolerance	I_{LOAD} = 0mA, T_{AMB} = 25°C	-1		1	%
		I_{LOAD} = 0mA	-2		2	%
$V_{LINEREG}$	Line Regulation, Static	$V_{OUT(NOM)}$+0.3V to 5.4V	-1		1	%
$V_{LOADREG}$ [1]	Load Regulation, Static	I_{LOAD} = 0 to 50 mA		0.5	2.5	mV
		I_{LOAD} = 0 to 300 mA		3	10	mV
V_{IH}	Enable Input Voltage High		1.5			V
V_{IL}	Enable Input Voltage Low				0.4	V
I_{LOAD}	Output Current		0		300	mA
I_{LIMIT}	Output Current Limitation			450		mA
VNoise	Output Noise Voltage	10Hz to 100kHz, C_{REF} = 100nF		40		μV_{RMS}
	Thermal Protection			150		°C

1. Guaranteed by design and verified by lab evaluation.
2. Startup is performed if any EN pin goes high.

Note: All limits are guaranteed. The parameters with min and max values are guaranteed with production tests or SQC (Statistical Quality Control) methods.

7 Typical Operating Characteristics

V_{DD} = *4V,* V_{OUT} = 3.3V, C_{OUT} = *1µF,* T_{AMB} = +25°C (unless otherwise specified);

Figure 3. Load Regulation; V_{OUT} vs. I_{OUT}

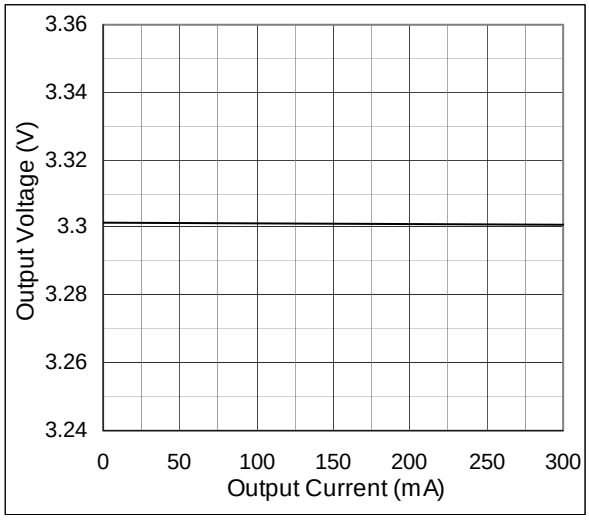


Figure 4. Line Regulation; V_{OUT} vs. V_{IN}

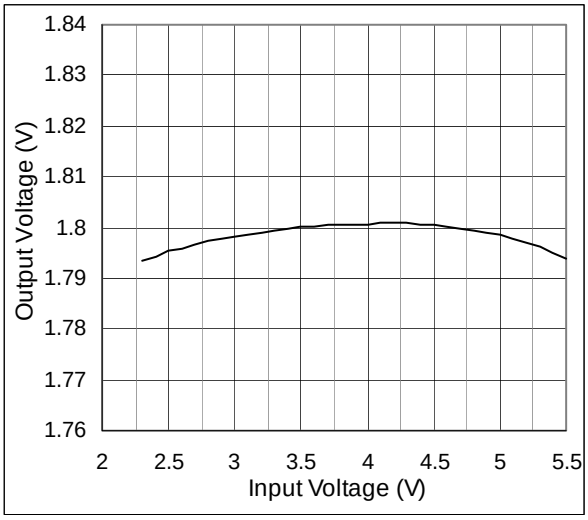


Figure 5. Output Voltage vs. Temp.; I_{OUT} = 1mA

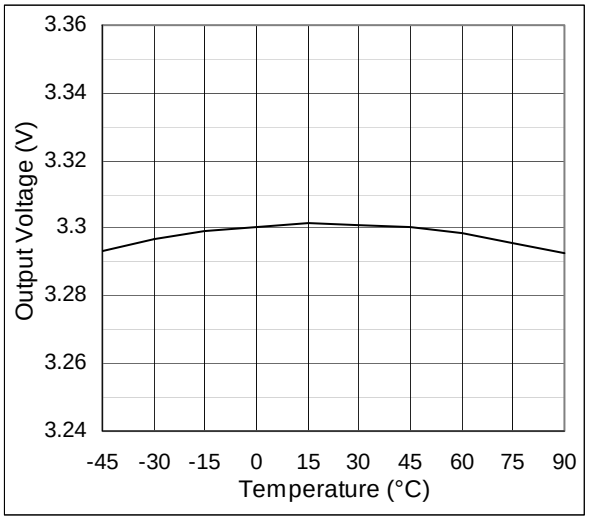


Figure 6. Quiescent Current vs. Temperature

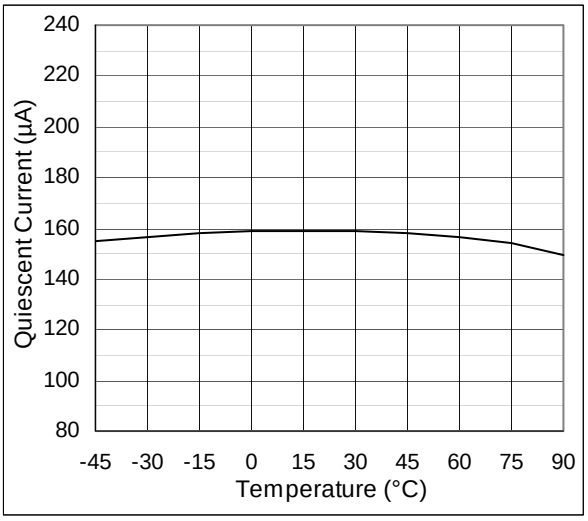


Figure 7. Startup; no Load, no C_{REF}

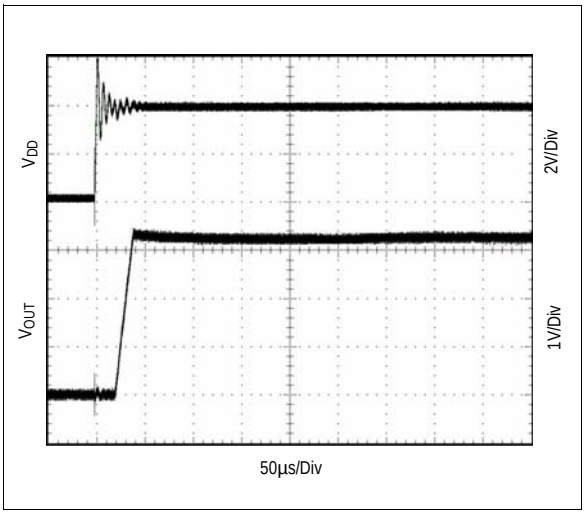


Figure 8. Startup; R_{LOAD} = 11Ω, no C_{REF}

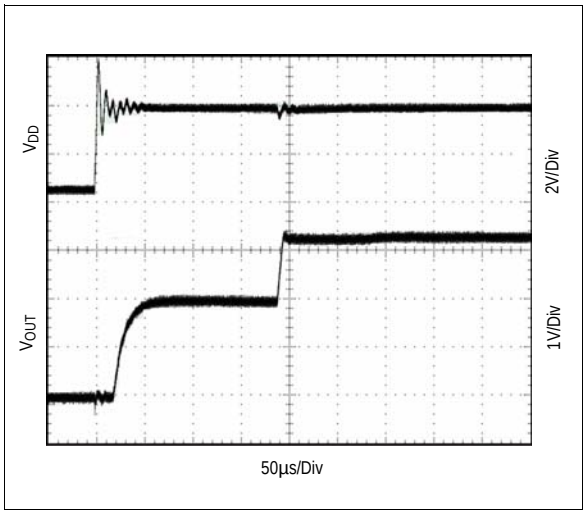


Figure 9. Startup; no Load, C_{REF} = 100nF

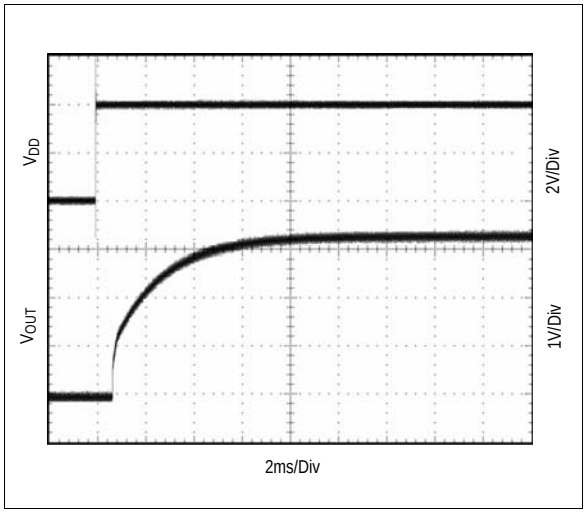


Figure 10. Startup; R_{LOAD} = 11Ω, C_{REF} = 100nF

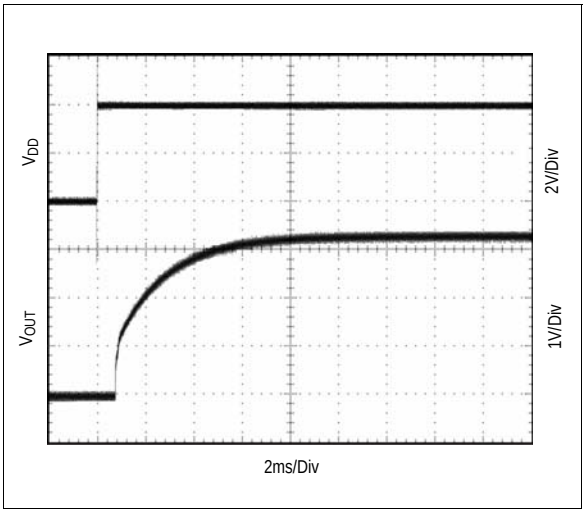


Figure 11. Startup; no Load, C_{REF} = 100nF (pre-charged)

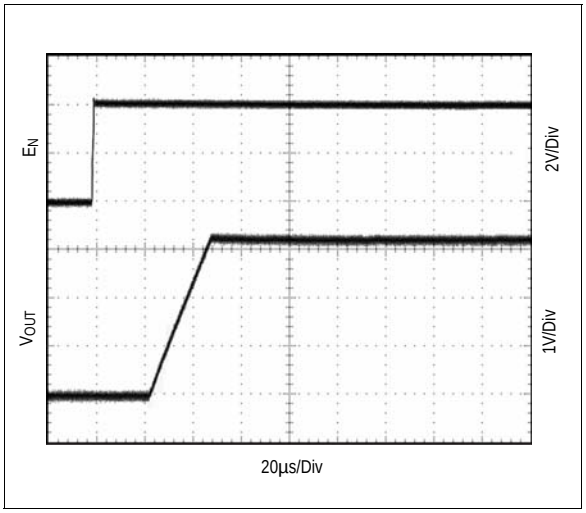


Figure 12. Startup; R_{LOAD} = 11Ω, C_{REF} = 100nF (pre-charged)

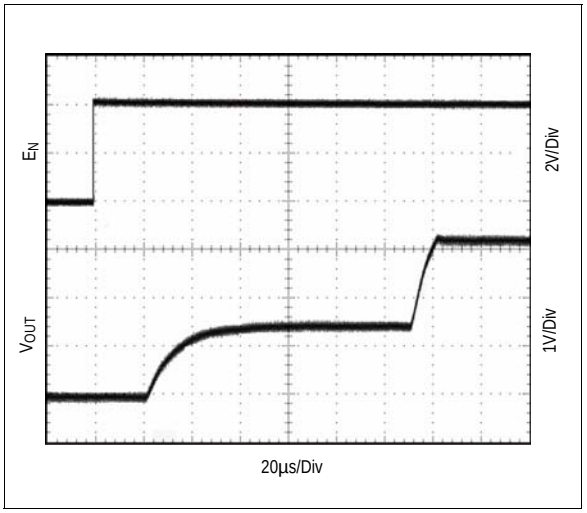


Figure 13. Load Transient Response; I_{OUT} = 0 to 300mA

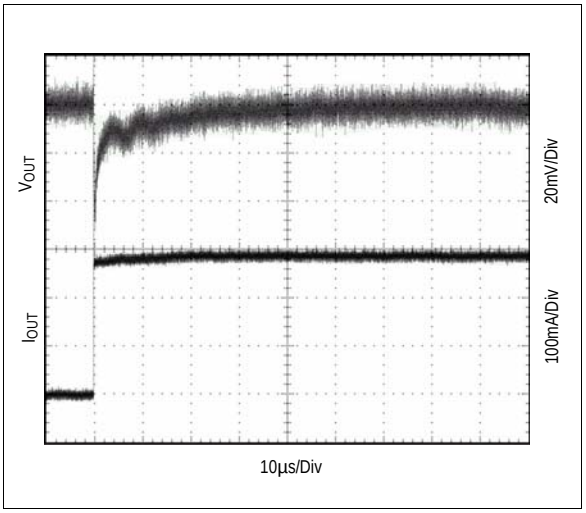
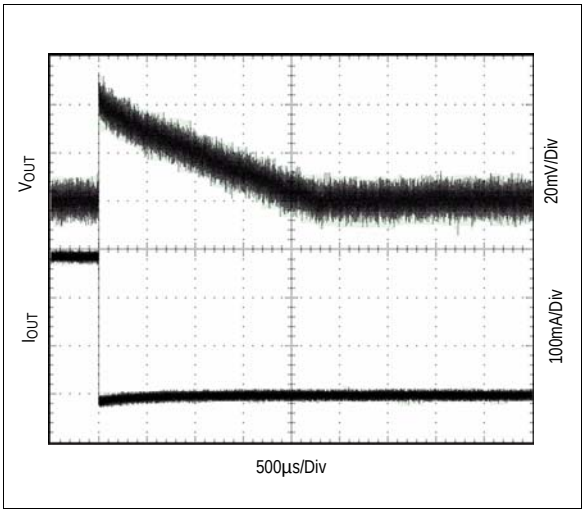
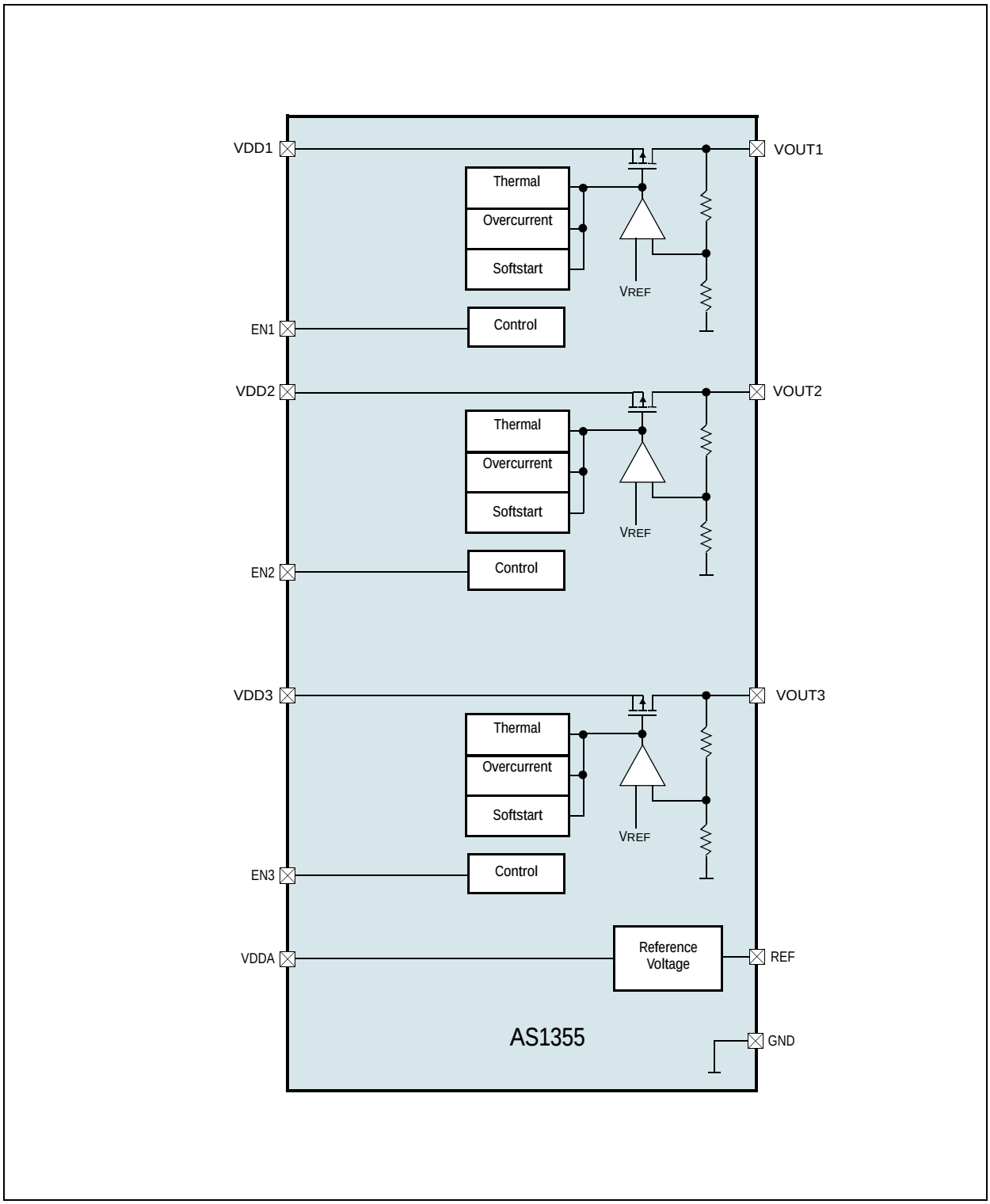


Figure 14. Load Transient Response; I_{OUT} = 300 to 0mA



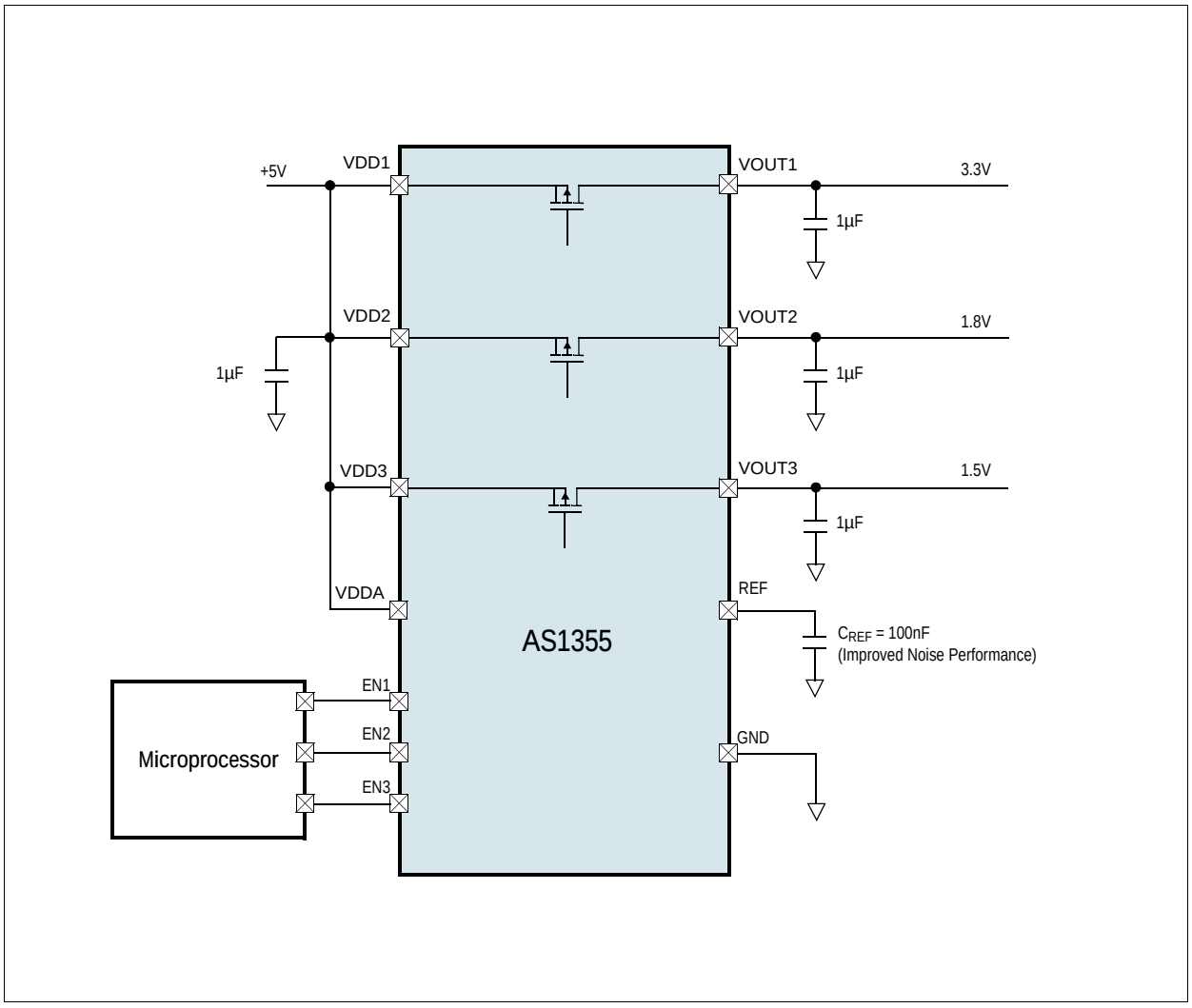
8 Detailed Description

Figure 15. AS1355 - Block Diagram



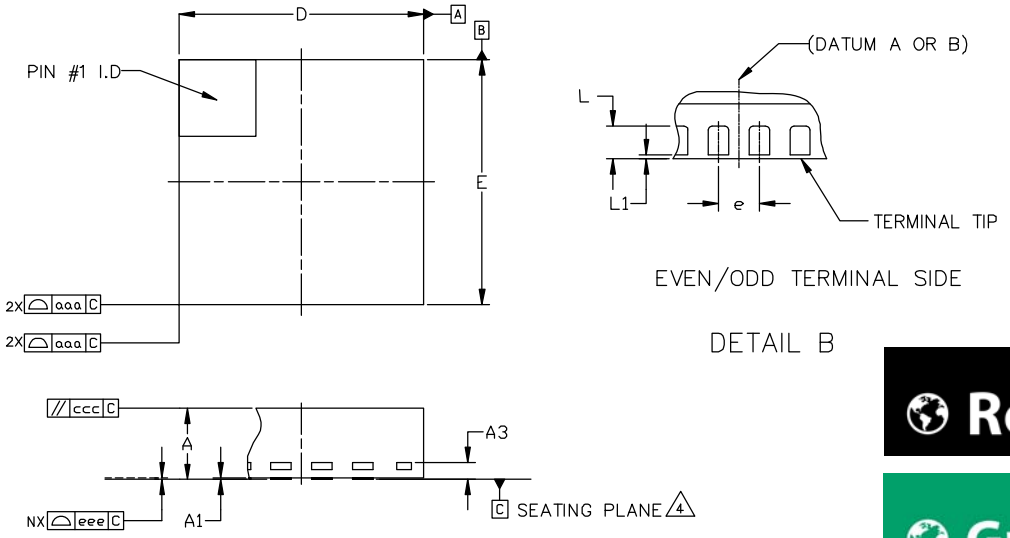
9 Typical Application

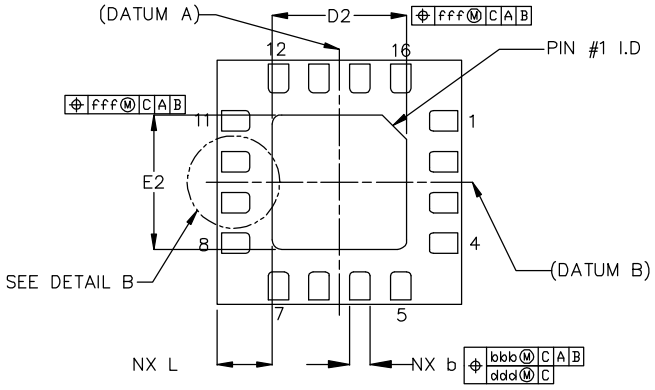
Figure 16. Typical Application



10 Package Drawings and Markings

Figure 17. 16-pin QFN 3x3 Package

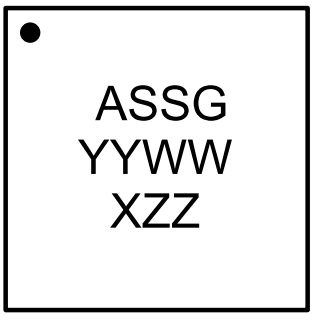




REF.	MIN	NOM	MAX
A	0.80	0.90	1.00
A1	0	0.02	0.05
A3	–	0.20 REF	–
L	0.35	0.40	0.50
L1	0.00	–	0.15
b	0.18	0.25	0.30
D		3.00 BSC	
E		3.00 BSC	
e		0.50 BSC	
D2	1.55	1.65	1.75
E2	1.55	1.65	1.75
aaa	–	0.15	–
bbb	–	0.10	–
ccc	–	0.10	–
ddd	–	0.05	–
eee	–	0.08	–
fff	–	0.10	–
N		16	

NOTE:

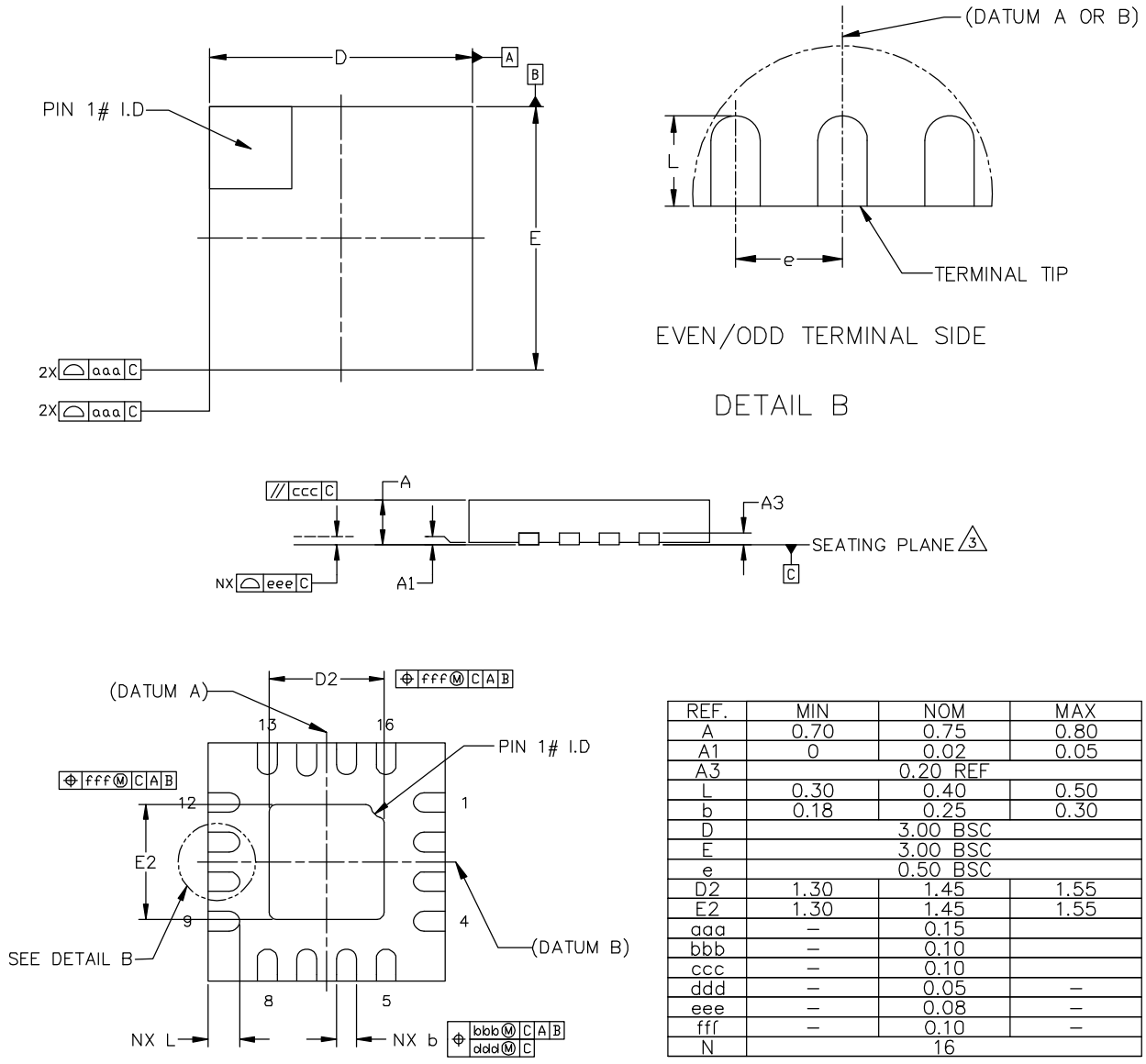
1. DIMENSIONS & TOLERANCEING CONFIRM TO ASME Y14.5M–1994.
2. ALL DIMENSIONS ARE IN MILLIMETERS. ANGELS ARE IN DEGREES.
3. DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.25mm AND 0.30mm FROM TERMINAL TIP. DIMENSION L1 REPRESENTS TERMINAL FULL BACK FROM PACKAGE EDGE UP TO 0.15mm IS ACCEPTABLE.
4. COPLANARITY APPLIES TO THE EXPOSED HEAT SLUG AS WELL AS THE TERMINAL.
5. RADIUS ON TERMINAL IS OPTIONAL.
6. N IS THE TOTAL NUMBER OF TERMINALS.



Marking: YYWWIZZ.

YY	WW	X	ZZ
last two digits of the current year	manufacturing week	plant identifier	free choice / traceability code

Figure 18. 16-pin TQFN 3x3 Package



REF.	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
A3		0.20 REF	
L	0.30	0.40	0.50
b	0.18	0.25	0.30
D		3.00 BSC	
E		3.00 BSC	
e		0.50 BSC	
D2	1.30	1.45	1.55
E2	1.30	1.45	1.55
aaa	–	0.15	
bbb	–	0.10	
ccc	–	0.10	
ddd	–	0.05	–
eee	–	0.08	–
fff	–	0.10	–
N		16	

NOTE:

1. DIMENSIONS & TOLERANCEING CONFIRM TO ASME Y14.5M–1994.
2. ALL DIMENSIONS ARE IN MILLIMETERS. ANGELS ARE IN DEGREES.
3. COPLANARITY APPLIES TO THE EXPOSED HEAT SLUG AS WELL AS THE TERMINAL.
5. RADIUS ON TERMINAL IS OPTIONAL.
6. N IS THE TOTAL NUMBER OF TERMINALS.

11 Ordering Information

The devices are available as the standard products shown in Table 4.

Table 4. Ordering Information

Ordering Code	Marking	Output	Description	Delivery Form	Package
AS1355-BQFT-WGD	ASSG	V_{OUT1} = 3.3V V_{OUT2} = 1.8V V_{OUT3} = 1.5V	300mA, Triple LDO	Tape and Reel	16-pin QFN 3x3
AS1355-BQFT-WWW	ASSV	V_{OUT1} = 3.3V V_{OUT2} = 3.3V V_{OUT3} = 3.3V	300mA, Triple LDO	Tape and Reel	16-pin QFN 3x3
AS1355-BQFT-WWD2	ASTD	V_{OUT1} = 3.3V V_{OUT2} = 3.3V V_{OUT3} = 1.5V	300mA, Triple LDO	Tape and Reel	16-pin TQFN 3x3
AS1355-BQFT-xyz*	____	V_{OUT1}* V_{OUT2}* V_{OUT3}*	300mA, Triple LDO	Tape and Reel	16-pin QFN 3x3

* These devices are available in factory-set output voltages from 1.25V to 3.6V in 100mV increments. Choose the desired V_{OUT} suffix from Table 5 and insert it instead of “xyz” in the part number.

On request also non-standard devices with output voltages between 1.25V and 3.6V in 50mV steps are available.

Table 5. Output Voltage Suffix Guide

Suffix	Min	Typ	Max		Suffix	Min	Typ	Max		Suffix	Min	Typ	Max
A		1.25			J		2.1			S		3.0	
B		1.3			K		2.2			T		3.1	
C		1.4			L		2.3			V		3.2	
D		1.5			M		2.4			W		3.3	
E		1.6			N		2.5			X		3.4	
F		1.7			O		2.6			Y		3.5	
G		1.8			P		2.7			Z		3.6	
H		1.9			Q		2.8			2	thin QFN		
I		2.0			R		2.9						

Note: All products are RoHS compliant and ams green.
Buy our products or get free samples online at www.ams.com/ICdirect

Technical Support is available at www.ams.com/Technical-Support

For further information and requests, email us at sales@ams.com
(or) find your local distributor at www.ams.com/distributor

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