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600mA Synchronous DC-DC Step Down Regulator (1ch)
300mA LDO Regulator (4ch)
Multi Power Supply (High Efficiency Power LSI)

FEATURES

- High-Speed Response DC-DC Step Down Regulator Circuit that employs Hysteretic System
- DC-DC Step Down Regulator : 1-ch
  Input voltage Range VBAT :2.5V to 5.5V
  　　　　　　　　　　DVDD : 1.7V to 3.0V
  Output voltage Range 0.8 V to 2.4 V
  Up to 600 mA Output Current

- LDO Regulator : 4-ch
  Input voltage Range VBAT :2.5V to 5.5V
  　　　　　　　　　　DVDD : 1.7V to 3.0V
  Output voltage Range 1.0 V to 3.3 V
  Up to 300 mA Output Current

- I²C control (2-slave address selectable)
- 20 pin Wafer Level Chip Size Package (WLCSP)
  (Size : 1.56 mm × 2.06 mm, 0.4 mm Pitch)

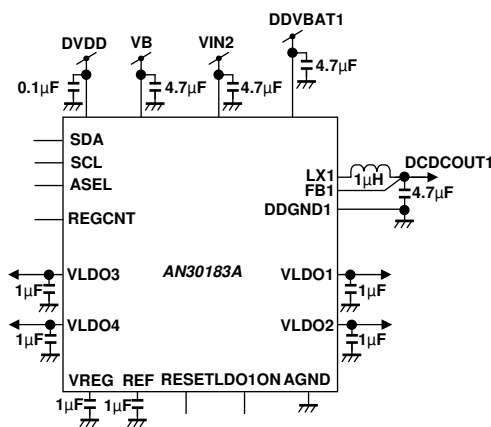## APPLICATIONS

Mobile phone, Portable appliance, etc

DESCRIPTION

AN30183A is a multi power supply LSI which has High-Speed Response DC-DC Step Down Regulators (1-ch) and LDO Regulators (4-ch).
By this DC-DC system, when load current charges suddenly, it responds at high speed and minimizes the changes of output voltage.
Since it is possible to use capacitors with small capacitance and it is unnecessary to add external parts for system phase compensation, this IC realizes downsizing of set and reducing in the number of external parts.
The output DC of each power supply is variable by I²C control.

SIMPLIFIED APPLICATION

Notes) This application circuit is an example. The operation of mass production set is not guaranteed. You should perform enough evaluation and verification on the design of mass production set. You are fully responsible for the incorporation of the above application circuit and information in the design of your equipment.

EFFICIENCY CURVE

AN30183A DCDC1 Efficiency

Vout=0.8V
Vout=1.2V
Vout=1.8V
Vout=2.4V
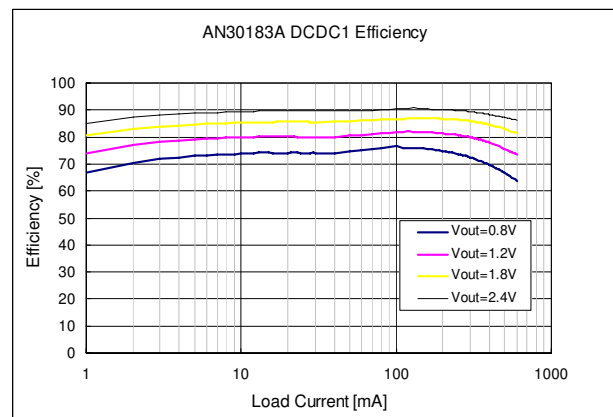
Condition)
DDVBAT1 = DDVBAT2 = VB = VIN2 = 3.7V
Lo = 1.0 µH, Cout = 4.7 µF

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Unit	Notes
Supply voltage	VB,VIN2,DDVBAT1	6.0	V	*1
	DVDD	3.6	V	*1
Output Current	I_{IN}	—	A	*1
Operating free-air temperature	T_{opr}	− 30 to + 85	°C	*2
Operating junction temperature	T_j	− 30 to + 150	°C	*2
Storage temperature	T_{stg}	− 55 to + 150	°C	*2
Input Voltage Range	RESET,LDO1ON,FB1, REGCNT	− 0.3 to V_{VBAT} + 0.3	V	*1 *3
	SCL,SDA,ASEL	− 0.3 to DVDD + 0.3	V	*1 *3
Output Voltage Range	LX1,VREG,REF,SDA LDO1,LDO2,LDO3,LDO4	− 0.3 to V_{VBAT} + 0.3	V	*1 *3
ESD	HBM (Human Body Model)	2	kV	—

Notes) Do not apply external currents and voltages to any pin not specifically mentioned.

This product may sustain permanent damage if subjected to conditions higher than the above stated absolute maximum rating. This rating is the maximum rating and device operating at this range is not guaranteeable as it is higher than our stated recommended operating range. When subjected under the absolute maximum rating for a long time, the reliability of the product may be affected.

 *1:The values under the condition not exceeding the above absolute maximum ratings and the power dissipation.

 *2:Except for the power dissipation, operating ambient temperature, and storage temperature, all ratings are for Ta = 25 °C.

 *3:V_{VBAT} is voltage for DDVBAT1 = VB = VIN2, (V_{VBA} + 0.3) V must not be exceeded 6 V.

  V_{DVDD} is voltage for DVDD, (V_{DVDD} + 0.3) V must not be exceeded 3.6 V.

POWER DISSIPATION RATING

PACKAGE	θ_{JA}	PD (Ta = 25 °C)	PD (Ta = 85 °C)	Notes
20 pin Wafer level chip size Package (WLCSP Type)	359.0 °C / W	0.348 W	0.181 W	*1

Note). For the actual usage, please refer to the PD-Ta characteristics diagram in the package specification, follow the power supply voltage, load and ambient temperature conditions to ensure that there is enough margin and the thermal design does not exceed the allowable value.

 *1:Glass Epoxy Substrate (4 Layers) [Glass-Epoxy: 50 X 50 X 0.8 t (mm)]

  Die Pad Exposed , Soldered.

CAUTION

Although this has limited built-in ESD protection circuit, but permanent damage may occur on it.
Therefore, proper ESD precautions are recommended to avoid electrostatic damage to the MOS gates

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RECOMMENDED OPERATING CONDITIONS

Parameter	Pin Name	Min.	Typ.	Max.	Unit	Notes
Supply voltage range	VB	2.5	3.7	5.5	V	*1
	VIN2	2.5	3.7	5.5	V	*1
	DDVBAT1	2.5	3.7	5.5	V	*1
	DVDD	1.7	1.85	3.0	V	*1
Input Voltage Range	RESET	− 0.3	—	V_{VBAT} + 0.3	V	*2
	LDO1ON	− 0.3	—	V_{VBAT} + 0.3	V	*2
	REGCNT	− 0.3	—	V_{VBAT} + 0.3	V	*2
	FB1	− 0.3	—	V_{VBAT} + 0.3	V	*2
	SCL	− 0.3	—	DVDD + 0.3	V	*2
	SDA	− 0.3	—	DVDD + 0.3	V	*2
	ASEL	− 0.3	—	DVDD + 0.3	V	*2
Output Voltage Rang	LX1	− 0.3	—	V_{VBAT} + 0.3	V	*2
	VREG	− 0.3	—	V_{VBAT} + 0.3	V	*2
	REF	− 0.3	—	V_{VBAT} + 0.3	V	*2
	SDA	− 0.3	—	DVDD + 0.3	V	*2
	VLDO1	− 0.3	—	V_{VBAT} + 0.3	V	*2
	VLDO2	− 0.3	—	V_{VBAT} + 0.3	V	*2
	VLDO3	− 0.3	—	V_{VBAT} + 0.3	V	*2
	VLDO4	− 0.3	—	V_{VBAT} + 0.3	V	*2

Note) Do not apply external currents and voltages to any pin not specifically mentioned.

Voltage values, unless otherwise specified, are with respect to GND. GND is voltage for AGND = DDGND1

V_{VBAT} is voltage for DDVBAT1 = VB = VIN2.

*1 : The values under the condition not exceeding the above absolute maximum ratings and the power dissipation.

*2 : (V_{VBAT} + 0.3) V must not be exceeded 6 V. (DVDD + 0.3) V must not be exceeded 3.6 V.

ELECRTRICAL CHARACTERISTICS

V_{VBAT}(DDVBAT1 = VB = VIN2) = 3.7V, DVDD = 1.85V
DC-DC : Co = 4.7 μF, Lo = 1 μH / LDO : Co =1.0 μF
T_a = 25 °C ± 2 °C unless otherwise noted.

Parameter		Symbol	Conditions	Limits			Unit	Notes
				Min	Typ	Max		
Consumption current								
	Consumption current 1 on active	IBAT_1	only LDO1 (PS mode) ON	—	10	20	μA	—
	Consumption current 2 on active	IBAT_2	DCDC1, LDO1-4 = ON	—	240	400	μA	—
	Static consumption current	IBAT_3	DCDC1, LDO1-4 = OFF RESET = "L"	—	0.1	1.0	μA	—

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ELECRTRICAL CHARACTERISTICS (Continued)

V_{VBAT}(DDVBAT1 = VB = VIN2) = 3.7V, DVDD = 1.85V

DC-DC : Co = 4.7 µF, Lo = 1 µH / LDO : Co =1.0 µF

T_a = 25 °C ± 2 °C unless otherwise noted.

Parameter	Symbol	Conditions	Limits			Unit	Notes
			Min	Typ	Max		
LDO1 – 4 (Normal Mode) - (LDO Regulator)							
Output voltage	VLDO	ILDO = − 150 mA Vout = 1.85 V setting	1.803	1.850	1.897	V	—
Output current	ILDO	—	300	—	—	mA	—
Load regulation	DVLDO	Δ ILDO = − 10 µA → − 150 mA	−5	20	50	mV	—
Line regulation	VLDOLR	VB = 3.1 V → 4.5 V ILDO = − 150 mA Vout = 1.85 V setting	− 10	0	10	mV	—
Short-circuit current	ISTLDO	VB = 3.7 V VLDO = 0 V	35	100	255	mA	—
LDO1 – 4 (Power Save Mode) - (LDO Regulator)							
Output voltage	VLDOPS	ILDO = − 5 mA Vout = 1.85 V setting	1.803	1.850	1.897	V	—
Output current	ILDOPS	—	10	—	—	mA	—
Load regulation	DVLDOPS	Δ ILDO = − 10 µA → − 5 mA	− 5	20	50	mV	—
Line regulation	VLDOLRPS	VB = 3.1 V → 4.5 V ILDO = − 5 mA Vout = 1.85 V setting	− 25	0	25	mV	—

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ELECRTRICAL CHARACTERISTICS (Continued)

V_{VBAT}(DDVBAT1= VB = VIN2) = 3.7V, DVDD = 1.85V

DC-DC : Co = 4.7 μF, Lo = 1 μH / LDO : Co =1.0 μF

T_a = 25 °C ± 2 °C unless otherwise noted.

Parameter	Symbol	Conditions	Limits			Unit	Notes
			Min	Typ	Max		
DCDC1 (DC-DC Step Down Regulator)							
Output voltage	VDCDC1	IDCDC1 = – 300 mA Vout = 1.2 V setting	1.170	1.200	1.230	V	—
Output current	IDCDC1	—	600	—	—	mA	—
Load regulation	DVDCDC1	Δ IDCDC1 = – 10 μA → – 500 mA Vout = 1.2 V setting	—	25	45	mV	—
Line regulation	VDCDC1LR	DDVBAT1 = 3.1 V → 4.5 V IDCDC1 = – 300 mA Vout = 1.2 V setting	—	4	13	mV	—
Oscillation frequency	ISTDCDC1	IDCDC1 = – 300 mA (CCM)	2	3	4	MHz	—
I/O characteristics of control terminal (RESET, LDO1ON, REGCNT)							
Low input voltage	VIL1	Voltage recognized as low level	—	—	0.45	V	—
High input voltage	VIH1	Voltage recognized as high level	1.2	—	—	V	—
Input pull-down resistance	PDR1	—	1	3	6	MΩ	—
I/O characteristics of control terminal (ASEL)							
Low input voltage	VIL2	Voltage recognized as low level	—	—	V_{DVDD} × 0.3	V	—
High input voltage	VIH2	Voltage recognized as high level	V_{DVDD} × 0.7	—	—	V	—

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APPLICATION INFORMATION

REFERENCE VALUES FOR DESIGN

V_{VBAT}(DDVBAT1 = VB = VIN2) = 3.7V, DVDD = 1.85V

T_a = 25 °C ± 2 °C unless otherwise noted.

Parameter	Symbol	Conditions	Reference values			Unit	Notes
			Min	Typ	Max		
I²C Bus (Internal I/O Stage Characteristics)							
Low-level input voltage	VIL1	Voltage which recognized that SDA and SCL are Low-level	– 0.5	—	$0.3 \times V_{DVDD}$	V	*1 *2
High-level input voltage	VIH1	Voltage which recognized that SDA and SCL are High-level	$0.7 \times V_{DVDD}$	—	$V_{DVDD\ max}$ + 0.5	V	*1 *2
Low-level output voltage 1	VOL1	V_{DVDD} > 2 V SDA(sink current) = 3 mA	0	—	0.4	V	*2
Low-level output voltage 2	VOL2	V_{DVDD} < 2 V SDA(sink current) = 3 mA	0	—	$0.2 \times V_{DVDD}$	V	*2
Input current each I/O pin	IL	SCL, SDA = $0.1 \times V_{DVDDmax}$ to $0.9 \times V_{DVDDmax}$	– 10	—	10	µA	*2
SCL clock frequency	FOSC	—	0	—	400	kHz	*2

Notes) *1 : The input threshold voltage of I²C bus (Vth) is linked to $V_{DVDD.}$

In case the pull-up voltage is not V_{DVDD}, the threshold voltage (Vth) is fixed to ((V_{DVDD} / 2) ± (Schmitt width) / 2) and High-level, Low-level of input voltage are not specified.

In this case, pay attention to Low-level (max.) value (V_{ILmax}).

It is recommended that the pull-up voltage of I²C bus is set to the I²C bus I/O stage supply voltage (V_{DVDD}).

*2 :Checked by design, not production tested.

APPLICATION INFORMATION (Continued)

REFERENCE VALUES FOR DESIGN

V_{VBAT}(DDVBAT1 = VB = VIN2) = 3.1V to 4.5V, V_{DVDD} = 1.85V , DC-DC : Co = 4.7 μF, Lo = 1 μH / LDO : Co =1.0 μF

T_a = 25 °C ± 2 °C unless otherwise noted.

Parameter	Symbol	Conditions	Reference values			Unit	Notes
			Min	Typ	Max		
LDO1 – 4 (Normal Mode) - (LDO Regulator)							
Output voltage	VLDO	ILDO = − 150 mA Vout = 1.85 V setting	1.803	1.850	1.897	V	*2
Consumption current on active	IREGLDO	Normal mode VB > Vout + 0.1 V or VIN2 > Vout + 0.1 V	25	50	75	μA	*2
I/O voltage difference	VSATLDO	ILDO = − 300 mA	0.3	—	—	V	*2
Ripple rejection	VLDORR	Δ VB = 3.7 V ± 0.15 V ILDO = − 150 mA fvin = 100 Hz to 10 kHz	—	− 60	− 40	dB	*2
Discharge resistance	RDISLDO	—	50	100	200	kΩ	*2
Load change characteristic	LTRLDO	ILDO = − 10 μA ↔ − 100 mA	—	30	150	mV	*2
LDO1 – 4 (Power Save Mode) - (LDO Regulator)							
Output voltage	VLDOPS	ILDO = − 5 mA Vout = 1.85 V setting	1.803	1.850	1.897	V	*2
Consumption current on active	IREGLDOPS	Power Save mode VB > Vout + 0.1 V or VIN2 > Vout + 0.1 V	1	3	5	μA	*2
Ripple rejection	VLDOPSRR	Δ VB = 3.7 V ± 0.15 V ILDO = − 5 mA fvin = 100 Hz to 10 kHz	—	− 10	− 5	dB	*2
Short-circuit current	ISTLDOPS	VB = 3.7 V VLDO = 0 V	5	20	40	mA	*2

Notes)   *2 :Checked by design, not production tested.

## APPLICATION INFORMATION (Continued)

REFERENCE VALUES FOR DESIGN

V_{VBAT}(DDVBAT1 = VB = VIN2) = 3.1V to 4.5V, DVDD = 1.85V , DC-DC : Co = 4.7 µF, Lo = 1 µH / LDO : Co =1.0 µF

T_a = 25 °C ± 2 °C unless otherwise noted.

Parameter	Symbol	Conditions	Reference values			Unit	Notes
			Min	Typ	Max		
DCDC1 (DC-DC Step Down Regulator)							
Output Voltage	VDCDC1	IDCDC1 = – 300 mA Vout = 1.2 V setting	1.170	1.200	1.230	V	*2
Consumption current on active	IREGDCCD1	IDCDC1 = 0 mA	10	25	40	µA	*2
Output over current limit	ILIMDCDC1	From FB1 × 100% to FB1 × 70% VB = 3.7 V	—	1.0	1.2	A	*2
Efficiency 1	EFFDCDC11	DDVBAT1 = 3.4 V VDCDC1 = 2.4 V IDCDC1 = – 150 mA	85	90	—	%	*2
Efficiency 2	EFFDCDC12	DDVBAT1 = 3.7 V VDCDC1 = 1.2 V IDCDC1 = – 150 mA	75	80	—	%	*2
LX leak current	ILXL1	DDVBAT1 = 5.5 V DCDC1 = Disable VLX1 = 0 V or 5.5 V	– 1	0	1	µA	*2
Discharge resistance	RDISDCDC1	—	0.5	1.0	2.0	kΩ	*2

Notes)　*2 :Checked by design, not production tested.

APPLICATION INFORMATION (Continued)

REFERENCE VALUES FOR DESIGN

V_{VBAT}(DDVBAT1 = VB = VIN2) = 3.1V to 4.5V, DVDD = 1.85V , DC-DC : Co = 4.7 μF, Lo = 1 μH / LDO : Co =1.0 μF

T_a = 25 °C ± 2 °C unless otherwise noted.

Parameter	Symbol	Conditions	Reference values			Unit	Notes
			Min	Typ	Max		
I²C bus (Internal I/O stage characteristics)							
Hysteresis of Schmitt trigger input 1	Vhys1	V_{IO} > 2 V, Hysteresis 1 of SDA, SCL	$0.05 \times V_{DVDD}$	—	—	V	*2
Hysteresis of Schmitt trigger input 2	Vhys2	V_{IO} < 2 V, Hysteresis 2 of SDA, SCL	$0.1 \times V_{DVDD}$	—	—	V	*2
Output fall time from V_{IHmin} to V_{ILmax}	Tof	Bus capacitance : 10 pF to 400 pF $I_P \leq$ 6 mA (V_{OLmax} = 0.6 V) I_P : Max. sink current	$20 + 0.1 \times C_b$	—	250	ns	*2
Pulse width of spikes which must be suppressed by the input filter	Tsp	—	0	—	50	ns	*2
Capacitance for each I/O pin	Ci	—	—	—	10	pF	*2
I²C bus (Bus line specifications)							
Hold time (repeated) START condition	$t_{HD:STA}$	The first clock pulse is generated after $t_{HD:STA.}$	0.6	—	—	μs	*2
Low period of the SCL clock	t_{LOW}	—	1.3	—	—	μs	*2
High period of the SCL clock	t_{HIGH}	—	0.6	—	—	μs	*2
Set-up time for a repeat START condition	$t_{SU:STA}$	—	0.6	—	—	μs	*2
Data hold time	$t_{HD:DAT}$	—	0	—	0.9	μs	*2
Data set-up time	$t_{SU:DAT}$	—	100	—	—	ns	*2
Rise time of both SDA and SCL signals	t_r	—	$20 + 0.1 \times C_b$	—	300	ns	*2
Fall time of both SDA and SCL signals	t_f	—	$20 + 0.1 \times C_b$	—	300	ns	*2
Set-up time of STOP condition	$t_{SU:STO}$	—	0.6	—	—	μs	*2
Bus free time between STOP and START condition	t_{BUF}	—	1.3	—	—	μs	*2

Notes)   *2 :Checked by design, not production tested.

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APPLICATION INFORMATION (Continued)
REFERENCE VALUES FOR DESIGN

V_{VBAT}(DDVBAT1 = VB = VIN2) = 3.1V to 4.5V, DVDD = 1.85V , DC-DC : Co = 4.7 μF, Lo = 1 μH / LDO : Co =1.0 μF

T_a = 25 °C ± 2 °C unless otherwise noted.

Parameter	Symbol	Conditions	Reference values			Unit	Notes
			Min	Typ	Max		
I²C bus (Bus line specifications) (continued)							
Capacitive load for each bus line	C_b	—	—	—	400	pF	*2 *3
Noise margin at the Low-level for each connected device	V_{nL}	—	$0.1 \times V_{DVDD}$	—	—	V	*2 *3
Noise margin at the High-level for each connected device	V_{nH}	—	$0.2 \times V_{DVDD}$	—	—	V	*2 *3
Consumption current							
Static consumption current 2	IBAT_4	DDVBAT1 = VB = VIN2 = 3.7 V DCDC1, LDO1 to 4 = OFF RESET= "H"	—	8	17	μA	*2

Notes) *2 :Checked by design, not production tested.

*3 :The timing of Fast-mode devices in I²C-bus is specified as the following.

All values referred to V_{IHmin} and V_{ILmax} level.
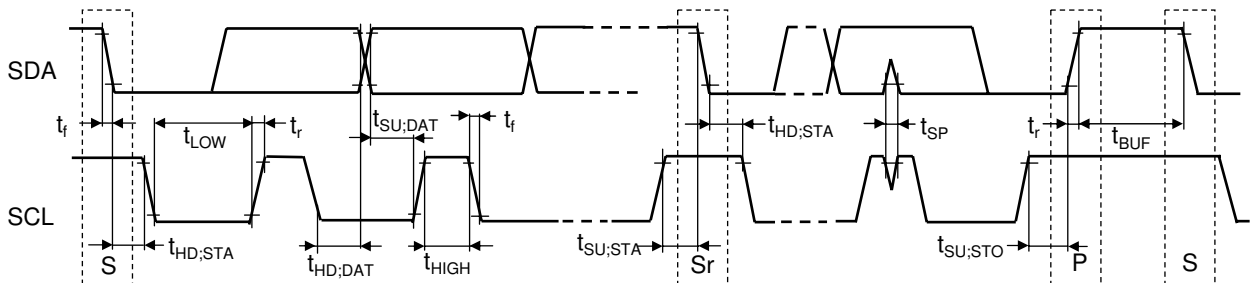
S : START condition

Sr : Repeat START condition

P : STOP condition

Notes) *2 :Checked by design, not production tested.

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PIN CONFIGURATION

TOP VIEW

	5	4	3	2	1
D	LX1	DD GND1	SDA	SCL	RESET
C	DD VBAT1	FB1	AGND	REG CNT	REF
B	VLDO1	VREG	ASEL	DVDD	VLDO4
A	VB	VLDO2	LDO1 ON	VLDO3	VIN2
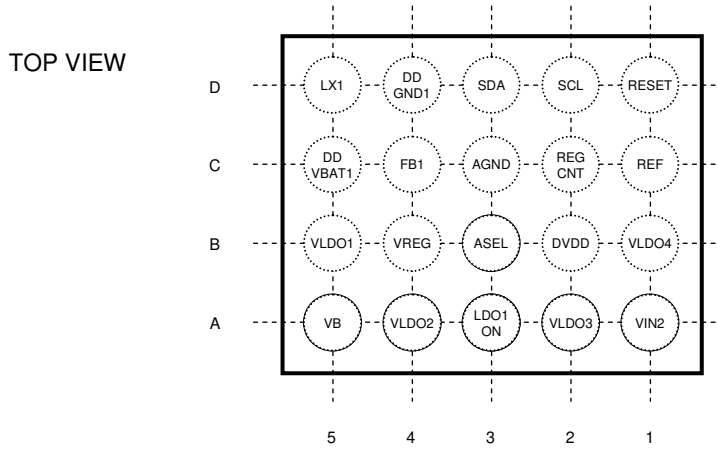
PIN FUNCTIONS

Pin No.	Pin name	Type	Description
A1	VIN2	Power Supply	Input for LDO3 and LDO4
A2	VLDO3	Output	LDO3 output
A3	LDO1ON	Input	LDO1 ON/OFF control
A4	VLDO2	Output	LDO2 output
A5	VB	Power Supply	Input for LDO1, LDO2 and other VB
B1	VLDO4	Output	LDO4 output
B2	DVDD	Power Supply	Power supply for Logic
B3	ASEL	Input	I²C slave address select
B4	VREG	Output	Reference output
B5	VLDO1	Output	LDO1 output
C1	REF	Output	Reference output
C2	REGCNT	Input	Control to select power setting
C3	AGND	Ground	GND
C4	FB1	Input	DCDC1 voltage feedback
C5	DDVBAT1	Power Supply	DCDC1 input
D1	RESET	Input	Reset input for Logic
D2	SCL	Input	I²C clock input
D3	SDA	Input/Output	I²C data input/output
D4	DDGND1	Ground	GND
D5	LX1	Output	DCDC1 switching

Notes) Concerning detail about pin description, please refer to OPERATION and APPLICATION INFORMATION section.

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FUNCTIONAL BLOCK DIAGRAM
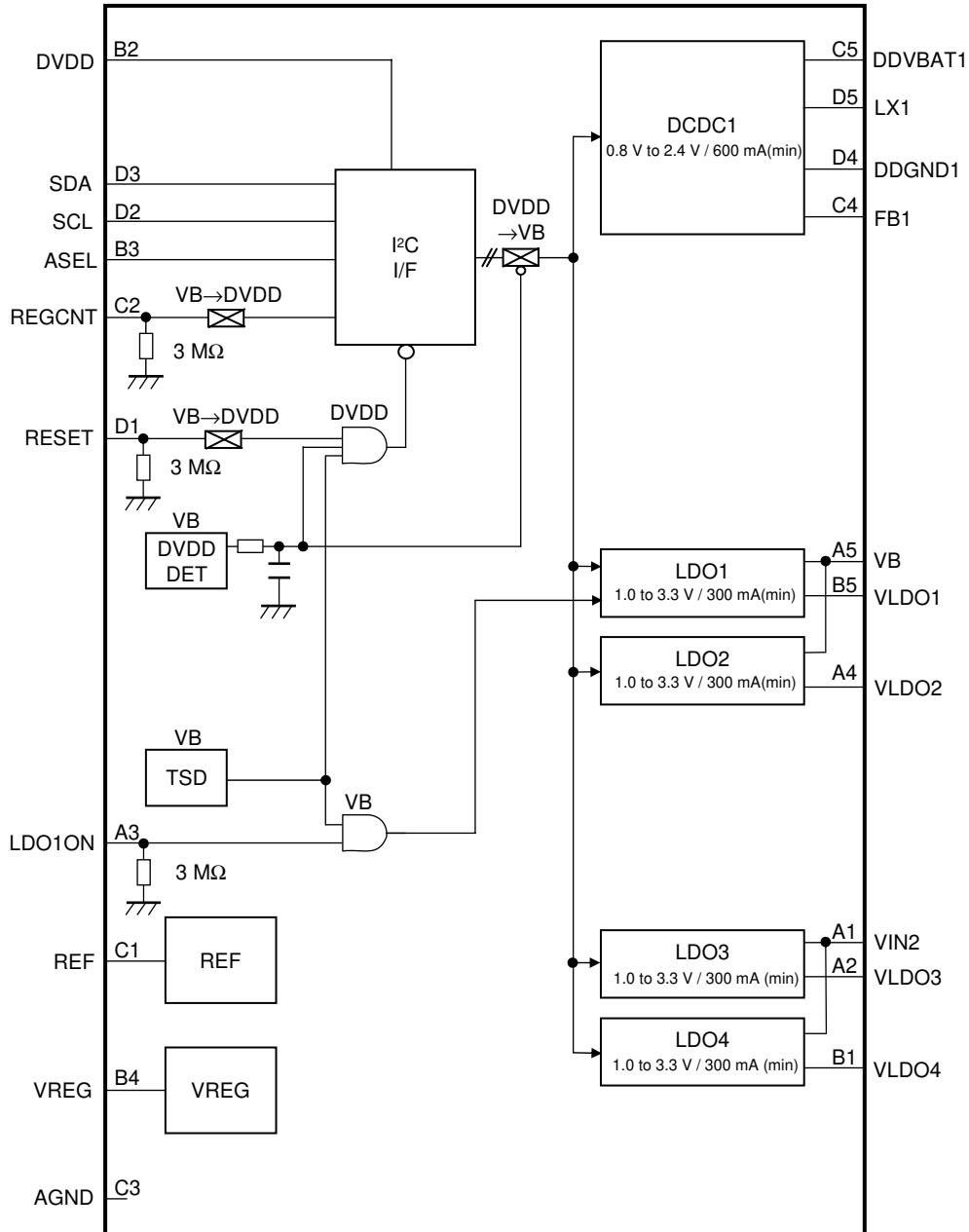
Notes) • This application circuit is an example. The operation of mass production set is not guaranteed.
You should perform enough evaluation and verification on the design of mass production set.
You are fully responsible for the incorporation of the above application circuit and information
in the design of your equipment.
• This block diagram is for explaining functions. Part of the block diagram may be omitted, or it may be simplified.

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TYPICAL CHARACTERISTICS CURVES

(1) Output Ripple Voltage of DC-DC1

V_{IN} = 3.7 V, DC-DC1_Vout = 1.2 V , L1 = 1 µH , CDCDCOUT1 = 4.7 µF

DC-DC1 , Iout = 0mA

DC-DC1 , Iout = 100mA

DC-DC1 , Iout = 600mA
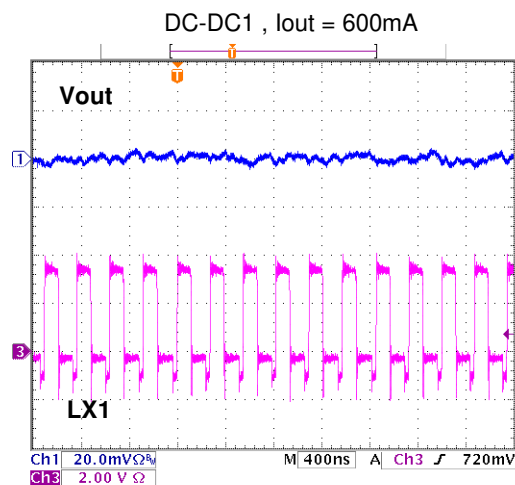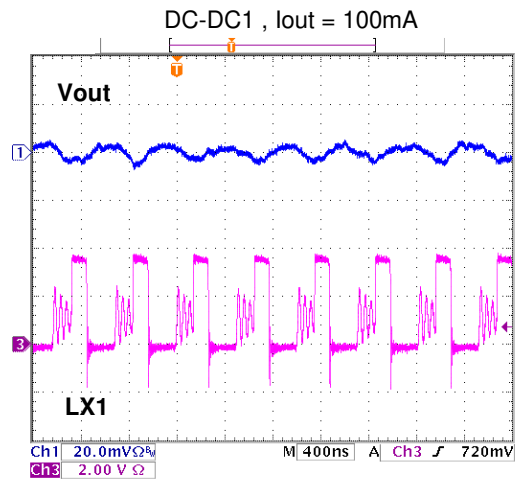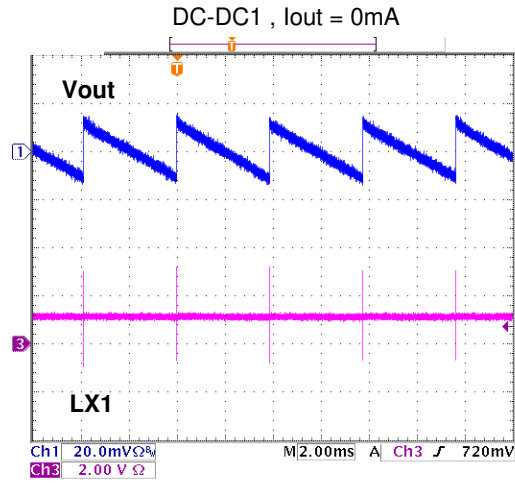
TYPICAL CHARACTERISTICS CURVES (Continued)

(2) Load Transient of DC-DC1

V_{IN} = 3.7 V, DC-DC1_Vout = 1.2 V , L1 = 1 µH , CDCDCOUT1 = 4.7 µF

DC-DC1 , Iout = 10µA to 500mA
(∆T=500mA/usec)

DC-DC1 , Iout = 500mA to 10µA
(∆T=500mA/usec)

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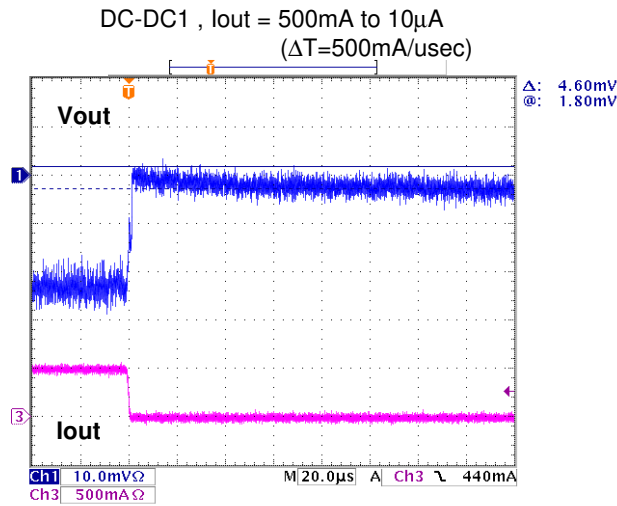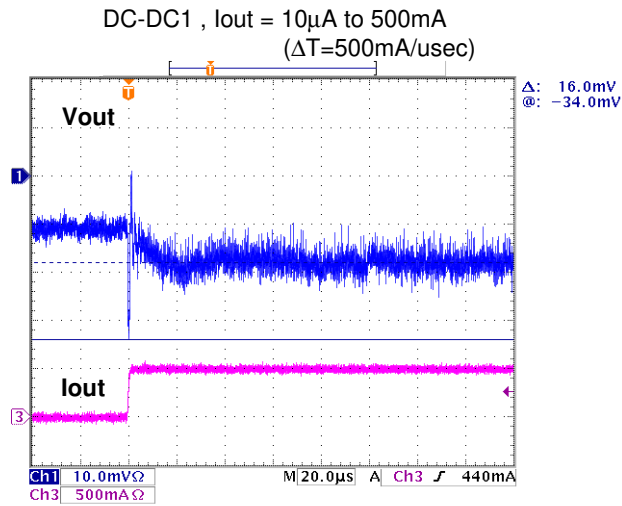
TYPICAL CHARACTERISTICS CURVES (Continued)

(3) Efficiency of DC-DC1
V_{IN} = 3.7 V, DC-DC1_Vout = 1.2 V , L1 = 1 μH , CDCDCOUT1 = 4.7 μF

AN30183A DC-DC1 Efficiency

Efficiency [%] vs Load Current [mA]

Vout=0.8V
Vout=1.2V
Vout=1.8V
Vout=2.4V
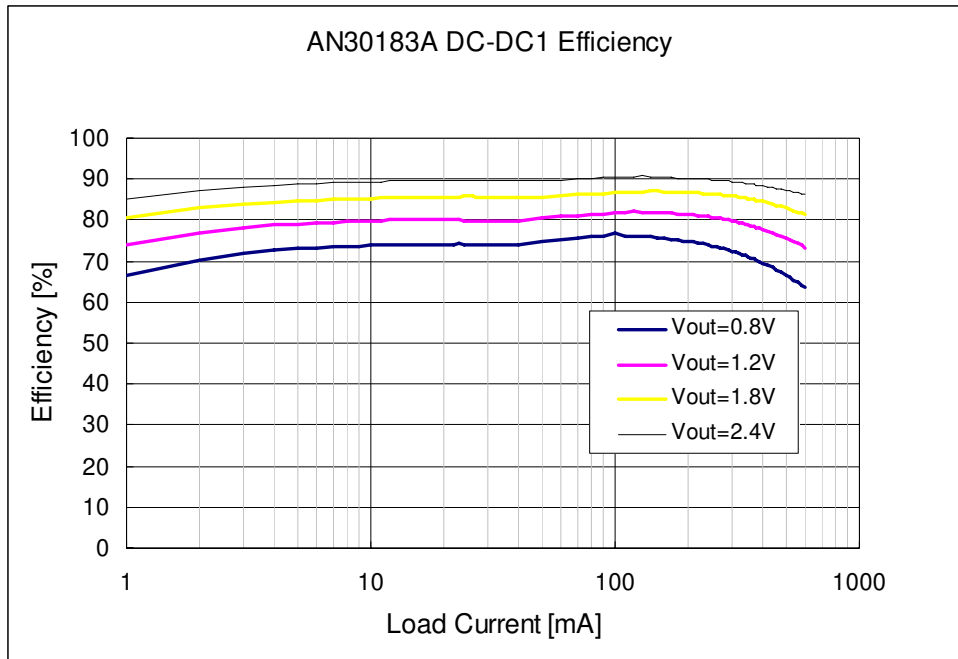
TYPICAL CHARACTERISTICS CURVES (Continued)

(4) Load Regulation of DC-DC1

V_{IN} = 3.7 V, DC-DC1_Vout = 1.2 V , L1 = 1 µH , CDCDCOUT1 = 4.7 µF
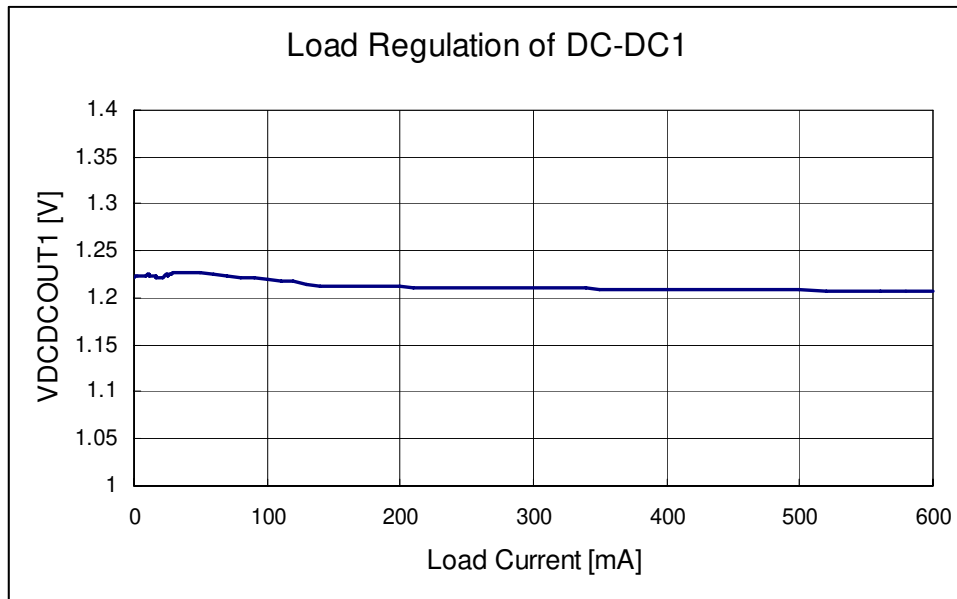
TYPICAL CHARACTERISTICS CURVES (Continued)

(5) Line Regulation of DC-DC1

Iout = 300mA, DC-DC1_Vout = 1.2 V, L1 = 1 µH , CDCDCOUT1 = 4.7 µF , V_{IN} = 2.4V to 5.5V

Line Regulation of DC-DC1
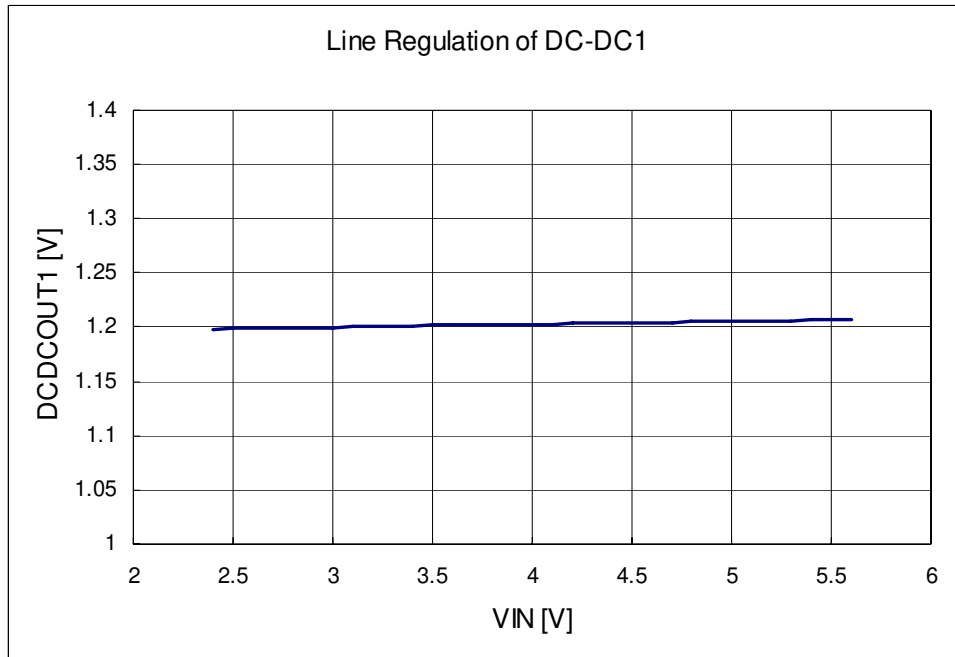
TYPICAL CHARACTERISTICS CURVES (Continued)

(6) Start Up & Shut Down of DC-DC1

V_{IN} = 3.7 V, DC-DC1_Vout = 1.2 V, L1 = 1 µH , CDCDCOUT1 = 4.7 µF

DC-DC1 , RDCDCOUT1 = No Load
Start Up

DC-DC1 , RDCDCOUT1 = No Load
Shut Down

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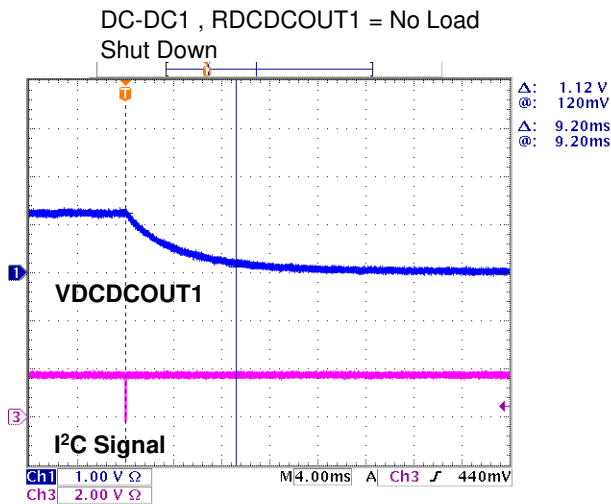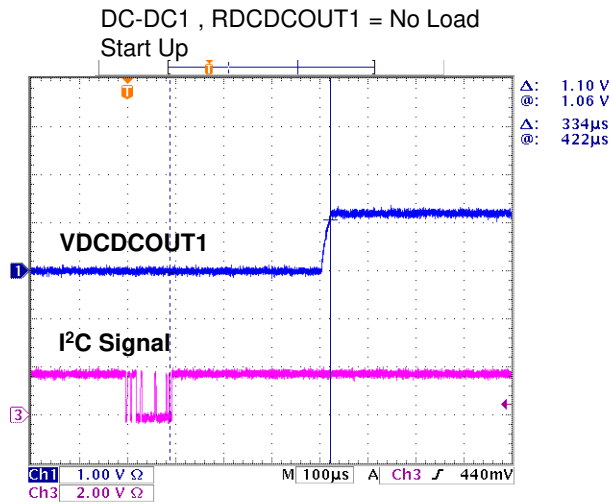
TYPICAL CHARACTERISTICS CURVES (Continued)

(7) Start Up & Shut Down of DC-DC1 (Continued)
  V_{IN} = 3.7 V, DC-DC1_Vout = 1.2 V, L1 = 1 µH , CDCDCOUT1 = 4.7 µF

DC-DC1 , RDCDCOUT1 = 4Ω
Start Up

DC-DC1 , RDCDCOUT1 = 4Ω
Shut Down
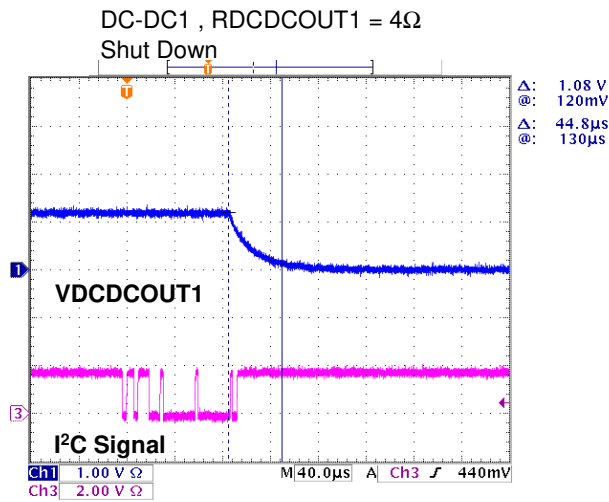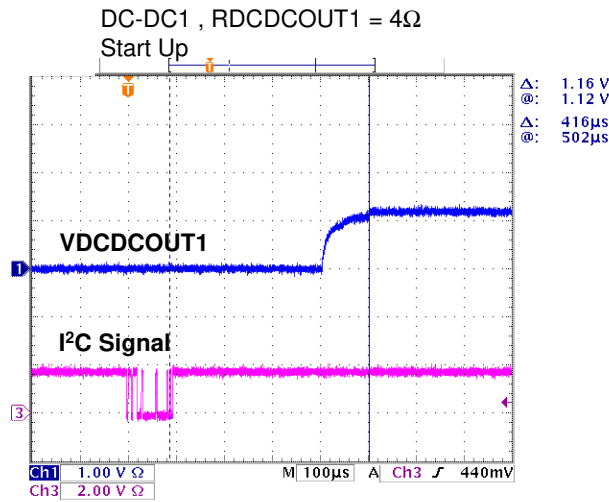
TYPICAL CHARACTERISTICS CURVES (Continued)

(8) Short Protection of DC-DC1

V_{IN} = 3.7 V, DC-DC1_Vout = 1.2 V, L1 = 1 µH , CDCDCOUT1 = 4.7 µF
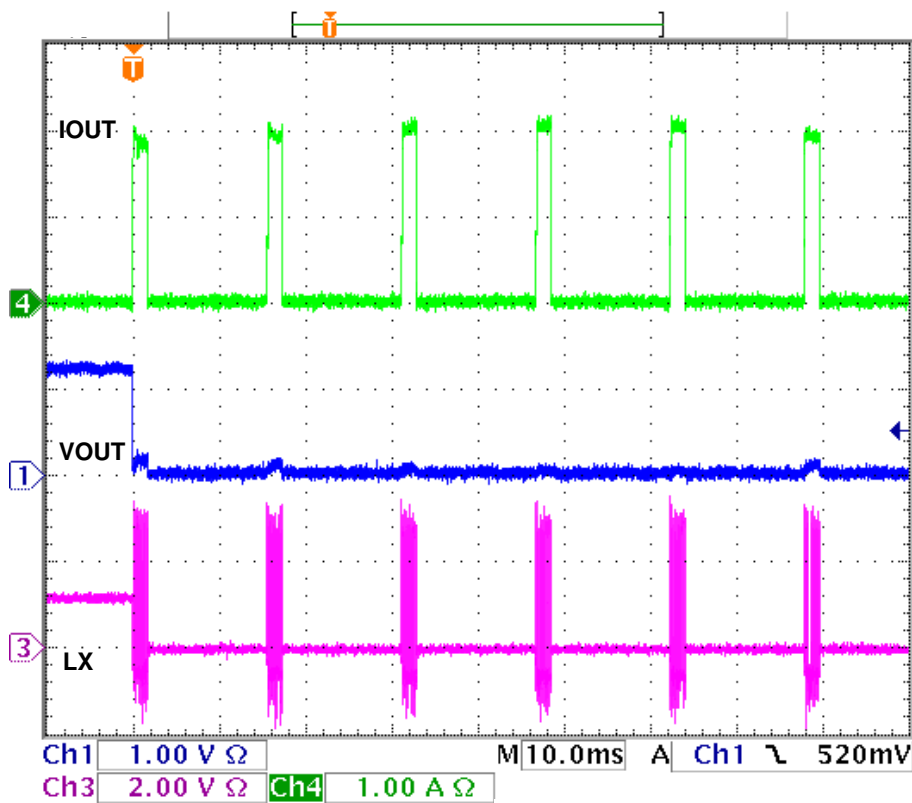
TYPICAL CHARACTERISTICS CURVES (Continued)

(9) Thermal Performance of DC-DC1

V_{IN} = 3.7 V, DC-DC1_Vout = 1.2 V, ILoad = 600mA , L1 = 1 µH , CDCDCOUT1 = 4.7 µF

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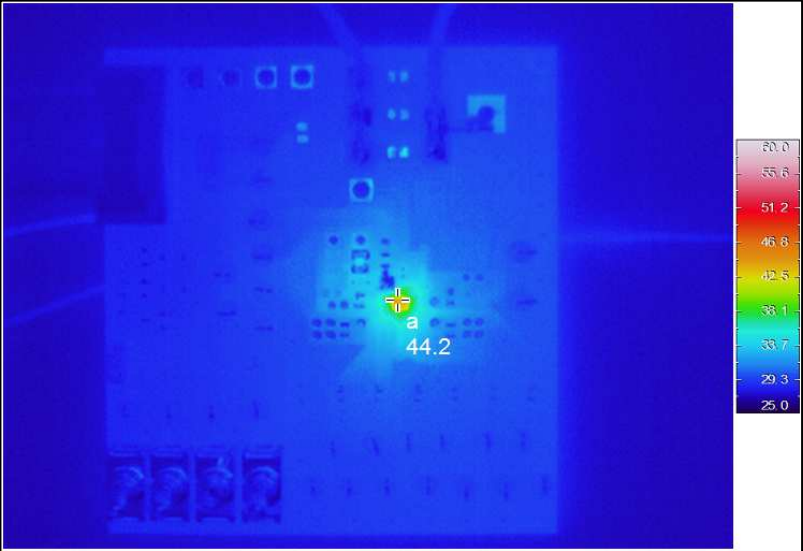
TYPICAL CHARACTERISTICS CURVES (Continued)

(10) Frequency of DC-DC1

V_{IN} = 3.7 V, DC-DC1_Vout = 1.2 V, L1 = 1 μH , CDCDCOUT1 = 4.7 μF

DC-DC1 , Iout = 0mA

DC-DC1 , Iout = 300mA

DC-DC1 , Iout = 600mA
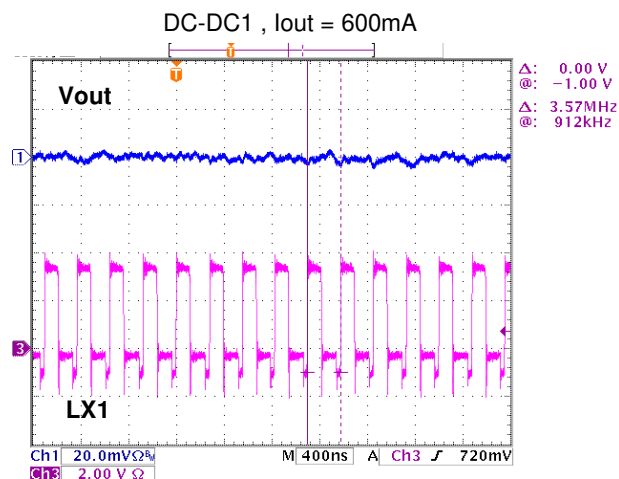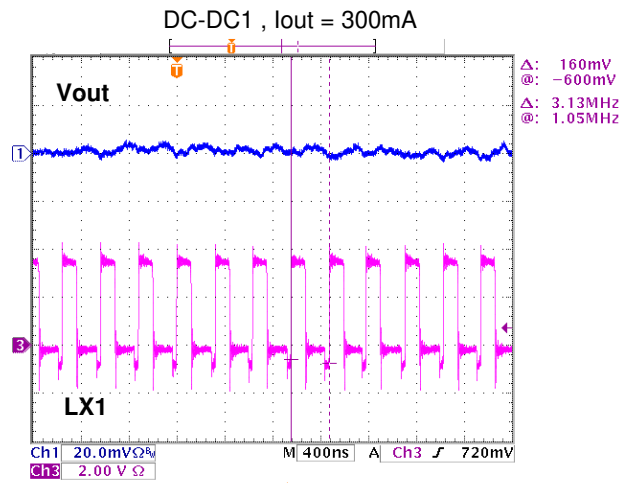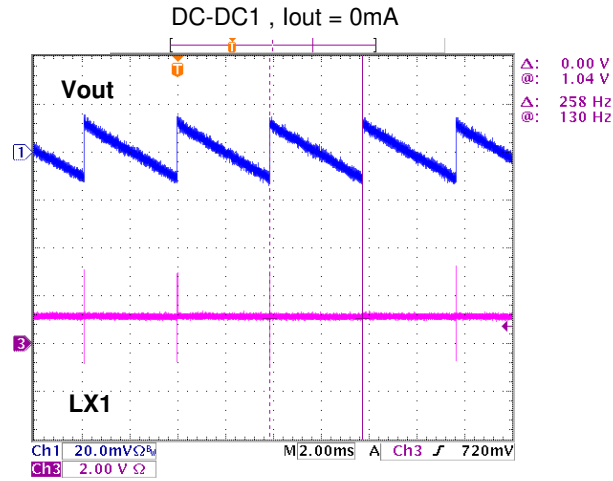
TYPICAL CHARACTERISTICS CURVES (Continued)

(11) Frequency of DC-DC1 (Continued)
    IOUT = 300mA, DC-DC1_Vout = 1.2 V, L1 = 1 µH , CDCDCOUT1 = 4.7 µF

DC-DC1 , VIN = 2.5V

DC-DC1 , VIN = 3.7V

DC-DC1 , VIN = 5.5V

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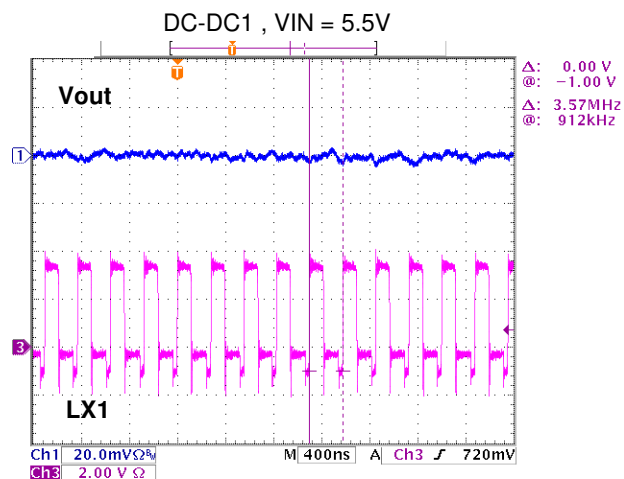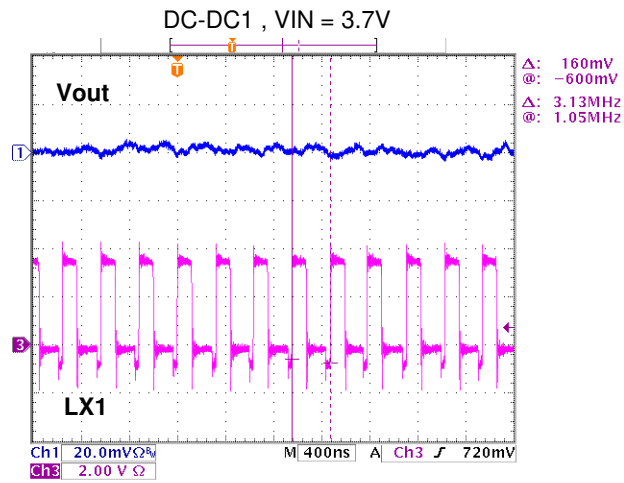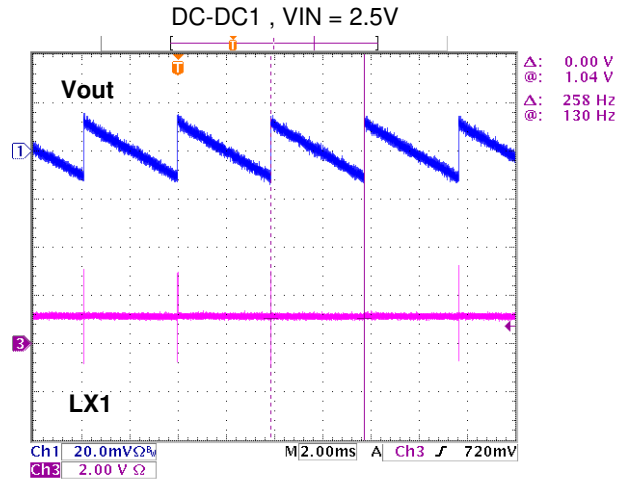
OPERATION

Note) The characteristics listed below are reference values derived from the design of the IC and are not guaranteed.

1. I²C-bus Interface

a.) Basic Rules

This IC, I2C-bus, is designed to correspond to the Standard-mode (100 kbps) and Fast-mode(400 kbps) devices in the version 2.1 of NXP's specification. However, it does not correspond to the HS-mode (to 3.4 Mbps). This IC will operate as a slave device in the I²C-bus system. This IC will not operate as a master device. The program operation check of this IC has not been conducted on the multi-master bus system and the mix-speed bus system, yet. The connected confirmation of this IC to the CBUS receiver also has not been checked. Please confirm with our company if the IC will be used in these mode systems. The I²C is the brand of NXP.

b.) START and STOP conditions

A High to Low transition on the SDA line while SCL is High is one such unique case. This situation indicates START condition. A Low to High transition on the SDA line while SCL is High defines STOP condition. START and STOP conditions are always generated by the master. After START condition occur, the bus will be busy. The bus is considered to be free again a certain time after the STOP condition.
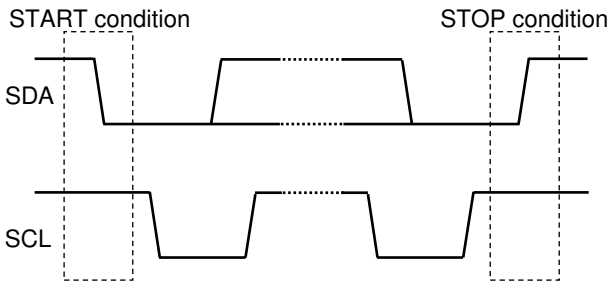
Every byte put on the SDA line must be 8-bits long. The number of bytes that can be transmitted per transfer is unrestricted. Each byte has to be followed by an acknowledge bit. Data is transferred with the most significant bit (MSB) first.
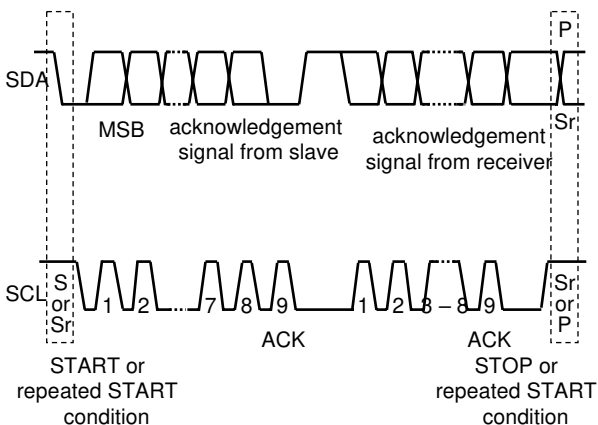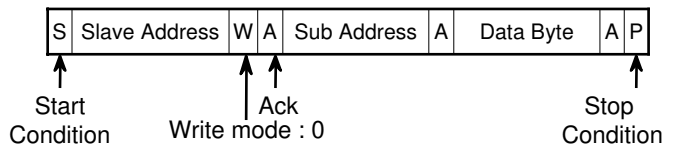

d.) Data format

Slave Address

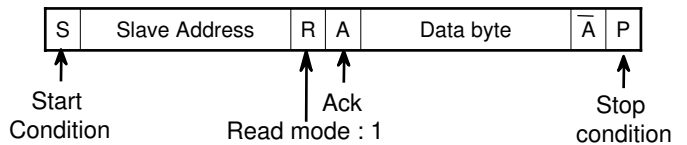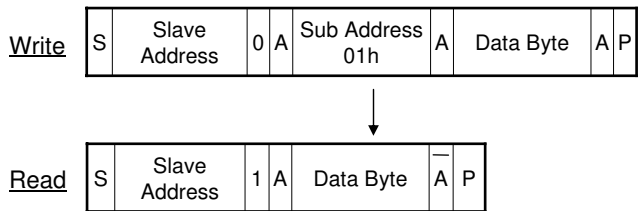| Pin ASEL	A6	A5	A4	A3	A2	A1	A0	R/W	Hex
Low	1	1	1	0	0	1	0	x	6Eh
High	1	1	1	0	0	1	1	x	6Fh

Write mode

Read mode

d1.) When Sub address is not specified

When data is read without assigning sub-address, it is possible to read the value of sub-address specified in Write mode immediately before.

Ex) When writing data into address and reading data from "01 h".

d2.) When Sub address is specified

Sub-address should be assigned first.

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