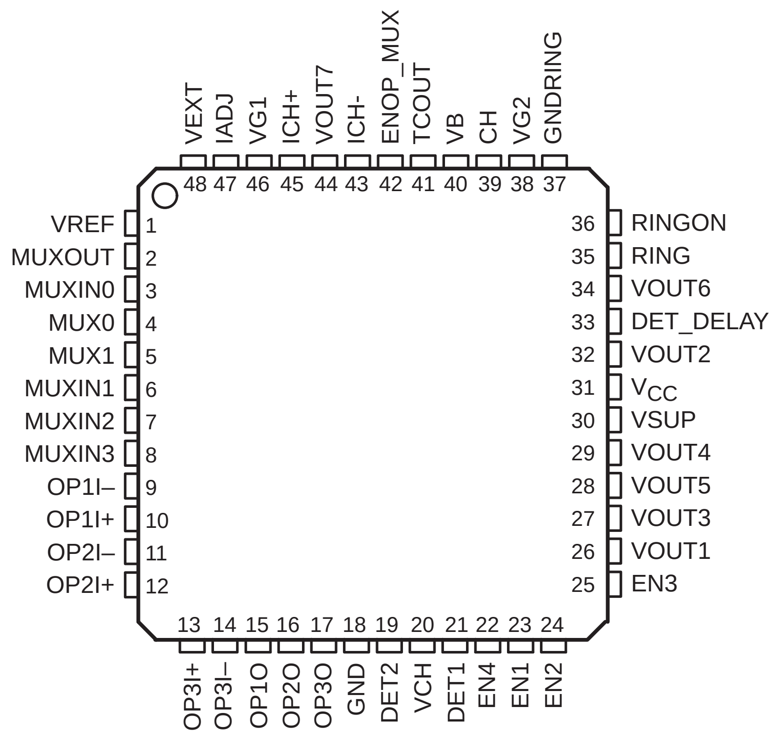
- **Li-Ion Battery Charging Control**
- **Over-Voltage Shutdown**
- **Seven Low-Dropout Low-Noise Linear Voltage Regulators (LDO)**
- **Voltage Detectors (With Power-Off Delay)**
- **Four-Channel Analog Multiplexer**
- **Three General-Purpose Operational Amplifiers**
- **Ringer Driver**
- **Power Supply Switch for Accessories**
- **Low Quiescent Current**
- **48-pin TQFP**

PFB PACKAGE
(TOP VIEW)



description

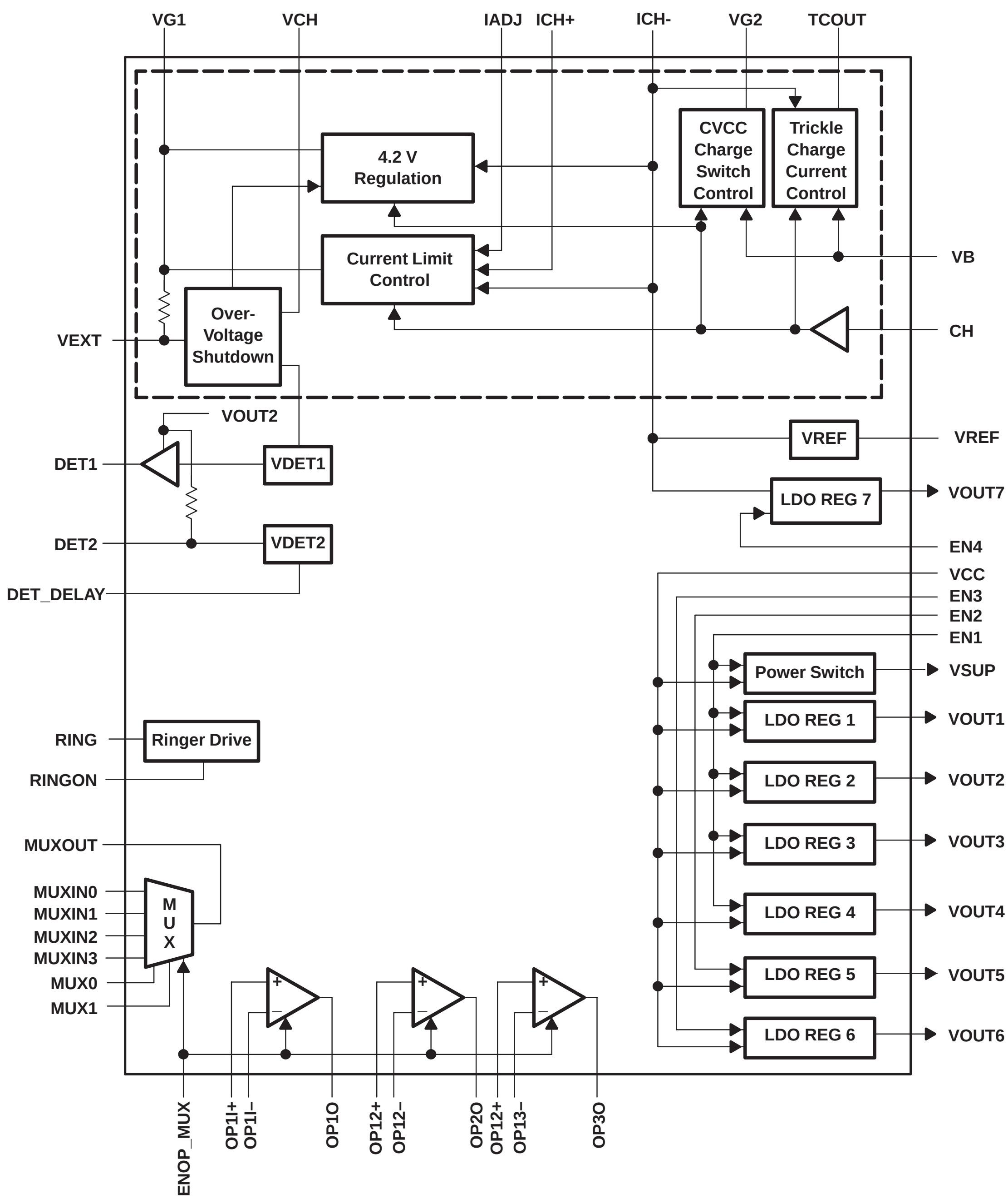
The TWL2203 incorporates a complete power-management system for a cellular telephone that uses lithium-ion cells. The device includes circuitry to control the gate voltage of two P-channel MOSFETs. The MOSFETs perform constant-voltage/constant-current charging (CVCC). The TWL2203 has seven low-drop linear voltage regulators (LDO) to regulate the battery power supply to the different sections of the phone, a battery voltage monitor, a ringer driver, an analog multiplexer, and three general-purpose operational amplifiers for signal conditioning.

The TWL2203 is packaged in TI's 48-pin thin-quad flat package (PFB).

AVAILABLE OPTIONS

T_A	PACKAGE
	PLASTIC THIN-QUAD FLAT PACKAGE (PFB)
–30°C to 85°C	TWL2203PFB

functional block diagram



Terminal Functions

TERMINAL		I/O	DESCRIPTION
NAME	NO. QFB		
CH	39	I	CMOS signal input set to logic high to enable battery-charging function
DET_DELAY	33	I/O	Delay programming pin for VDET2
DET1	21	O	Voltage detector CMOS output
DET2	19	O	Voltage detector output with 40-kΩ pull–up resistor
EN1	23	I	Set to logic high to enable LDO regulators 1–4 and power supply switch
EN2	24	I	Set to logic high to enable LDO regulator 5
EN3	25	I	Set to logic high to enable LDO regulator 6
EN4	22	I	Set to logic high to enable LDO regulator 7
ENOP_MUX	42	I	Set to logic high to enable the op amps and the analog multiplexer
GND	18		Ground for most sections of the device
GNDRING	37		Ringer ground
IADJ	47	I/O	Terminal for gain control of battery-charging current monitor
ICH–	43	I	Current-sense input/trickle charge, input/power supply to LDO regulator 7, and reference.
ICH+	45	I	Current-sense input
MUX0	4	I	Analog multiplexer channel selector bit-input (logic high is true)
MUX1	5	I	Analog multiplexer channel selector bit-input (logic high is true)
MUXIN0	3	I	Analog multiplexer input 0
MUXIN1	6	I	Analog multiplexer input 1
MUXIN2	7	I	Analog multiplexer input 2
MUXIN3	8	I	Analog multiplexer input 3
MUXOUT	2	O	Analog multiplexer output
OP1I–	9	I	Op amp 1 negative input
OP1I+	10	I	Op amp 1 positive input
OP1O	15	O	Op amp 1 output
OP2I–	11	I	Op amp 2 negative input
OP2I+	12	I	Op amp 2 positive input
OP2O	16	O	Op amp 2 output
OP3I–	14	I	Op amp 3 negative input
OP3I+	13	I	Op amp 3 positive input
OP3O	17	O	Op amp 3 output
RING	35	I	Ringer drive input
RINGON	36	I	Ringer enable (logic high to enable)
TCOUT	41	O	Trickle-charge output
V_B	40	I	Battery voltage input for charging control
V_{CC}	31		Power supply to most of the device
VCH	20	I	External power supply input for voltage detection
VEXT	48	I	External voltage input
VG1	46	O	MOSFET M1 gate drive
VG2	38	O	MOSFET M2 gate drive
VOUT1	26	O	LDO REG 1 output 1
VOUT2	32	O	LDO REG 2 output 2

Terminal Functions (Continued)

TERMINAL NAME	NO. QFB	I/O	DESCRIPTION
VOUT3	27	O	LDO REG 3 output 3
VOUT4	29	O	LDO REG 4 output 4
VOUT5	28	O	LDO REG 5 output 5
VOUT6	34	O	LDO REG 6 output 6
VOUT7	44	O	LDO REG 7 output 7
VREF	1	O	Voltage-reference bypass output
VSUP	30	O	Power-supply switch output

detailed description

battery-charging control

The battery charging control block in the device is a part of the lithium-ion battery (Li-Ion) charging system of the phone. It is capable of regulating the external power source to charge the lithium-ion battery according to the battery-charging requirements. More information on battery-charging control is presented in the *application information* section.

The MOSFET driver and its feedback-control circuit are enabled/disabled by a CMOS control signal provided by the phone's microprocessor. The maximum-charging current is set by external resistors for design flexibility.

overvoltage shutdown

The device shuts down the charging circuit in the presence of an overvoltage condition.

low-dropout linear voltage regulators

The device has seven separate low-dropout linear-voltage regulators. A single enable signal controls four of the regulators. The last three regulators are controlled by their own enable signals.

voltage detectors (with power-off delay)

The device has two voltage detectors. The voltage detectors monitor the voltage level of the external power and V_{CC}. The external power detector (VDET1) has a CMOS output. The V_{CC} detector (VDET2) activates on the falling edge and has user-adjustable power-off delay. There is an internal pullup resistor on the output.

analog multiplexer

The device has a four-channel analog multiplexer with two-bit channel-selector signal input and a shutdown function. In the shutdown mode, all the input and output terminals are in the high-impedance state.

operational amplifiers

The device has three rail-to-rail operational amplifiers with common shutdown control.

power supply switch for external phone accessories

The device provides current-limited voltage supply to the external phone accessories via the external-interface connector. The power supply switch is controlled by the same enable signal (EN1) that controls the four regulators—LDO1-LDO4. The external phone accessories are resistive in nature.

ringer driver

The device is capable of driving a ringer. It is controlled by a CMOS signal, and uses an N-channel low-side driver.

DISSIPATION-RATING TABLE – FREE-AIR TEMPERATURE

PACKAGE	T_A <25°C POWER RATING	OPERATING FACTOR ABOVE T_A = 25°C	T_A = 70°C POWER RATING	T_A = 85°C POWER RATING
PFB	1962 mW	15.7 mW/°C	1256 mW	1020 mW

absolute maximum ratings over operating free-air temperature (unless otherwise noted)†

Supply-voltage range, V_{CC} . . . . –0.3 V to 6.5 V
External-voltage range . . . . –0.3 V to 15 V
Output-voltage range . . . . –0.3 V to 6.5 V
Input-voltage range, all other pins . . . . –0.3 V to 6.5 V
Continuous total-power dissipation . . . . See Dissipation-Rating Table
Free-air temperature range . . . . –30°C to 85°C
Storage-temperature range . . . . –65°C to 150°C

† 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 or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

recommended operating conditions

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Supply voltage, V_{CC}	In regulation	2.85	3.75	4.25	V
	In transient condition	2.85		6	
VEXT	Allowable range	0	5.5	12	V
	Normal charging operation	4.6	5.5	6	
VCH		2.1		6	V
High-level logic input, V_{IH}		2.1			V
Low-level logic input, V_{IL}				0.9	V

electrical characteristics over recommended operating junction temperature range, V_{CC} = 3.75 V and VEXT = 5.5 V (unless otherwise specified)

current table, T_A = –40°C to 85°C

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Shutdown current	EN1 = EN2 = EN3 = EN4 = ENOP_MUX = VCH = CH = RINGON = VEXT = GND		50	90	µA
Quiescent current LDOreg. 1–4, power-switch quiescent current	EN1 = VOUT2, EN2 = EN3 = EN4 = ENOP_MUX = VCH = CH = RINGON = VEXT = GND		210	350	
Quiescent current LDOreg. 1–5, power-switch quiescent current	EN1 = EN2 = VOUT2, EN3 = EN4 = ENOP_MUX = VCH = CH = RINGON = VEXT = GND		240	400	
Quiescent current LDOreg. 1–6, power-switch quiescent current	EN1 = EN2 = EN3 = VOUT2, EN4 = ENOP_MUX = VCH = CH = RINGON = VEXT = GND		270	450	
Quiescent current LDOreg. 1–7, power-switch quiescent current	EN1 = EN2 = EN3 = EN4 = VOUT2, ENOP_MUX = VCH = CH = RINGON = VEXT = GND		300	500	
Quiescent current LDOreg. 1–7, Power-switch, MUX, op amp quiescent current	EN1 = EN2 = EN3 = EN4 = ENOP_MUX = VOUT2, VCH = CH = RINGON = VEXT = GND		470	800	
Quiescent current LDOreg. 1–4, Power-switch, MUX, op amp quiescent current	EN1 = ENOP_MUX = VOUT2, EN2 = EN3 = EN4 = RINGON = VCH = CH = VEXT = GND		370	700	
LDOreg. 1–7, Power-switch, MUX, op amp, charger quiescent current	VCH = 4.8 V, EN1 = EN2 = EN3 = EN4 = ENOP_MUX = CH = VOUT2, RINGON = GND		2.5	4.0	mA

battery charging control, T_A = 0°C to 50°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
	Constant voltage VB	Charge current = 50 mA, EN1 = CH = VOUT2, EN2 = EN3 = EN4 = ENOP_MUX = GND, VEXT = 5 – 6 V	4.15	4.20	4.25	V
	Voltage drop across sense resistor ICH+ – ICH–	CH = V_{CC}	85	100	115	mV
	Precharge current (VR6 threshold)	TCOUT – VB, VB<Vtc	75	125	175	mV
Vtc	Precharge threshold		3.30	3.40	3.50	V
Ipc	Precharge capability	VB = 3.5 V, TCIN = 4.15 V, R6 =2 Ω, Current limit control is disabled	50			mA

over-voltage shutdown, T_A = 0°C to 50°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Vchco	Over-voltage cutoff point for VCH		4.7	5.4	6	V
Vgco	Over-voltage cutoff point for VEXT		6.5	7.5	8.5	V

electrical characteristics over recommended operating junction temperature range, V_{CC} = 3.75 V and VEXT = 5.5 V (unless otherwise specified) (continued)

LDO regulator 1 (LCD Module), T_A = –20°C to 85°C

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Output voltage VOUT1	IOUT1 = 0.5 mA to 3 mA,	V_{CC} = 3.3 V to 4.2 V, EN1 = 3 V	2.95	3	3.05	V
Dropout voltage	IOUT1 = 1 mA				100	mV
Maximum current	V_{CC} = 3.75 V,	VOUT1 = 2.85 V	5			mA
Current limit	VOUT1 shorted to GND		7.5			mA
Ripple rejection	f = 400 Hz,	IOUT1 = 1 mA		50		dB

LDO regulator 2 (Digital), T_A = –30°C to 85°C

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Output voltage VOUT2	IOUT2 = 5 mA to 150 mA,	V_{CC} = 3.3 V to 4.2 V, EN1 = 3 V	2.825	3	3.175	V
Dropout voltage	IOUT2 = 80 mA				250	mV
Maximum current	V_{CC} = 3.75 V,	VOUT2 = 2.85 V	200			mA
Current limit	VOUT2 shorted to GND		300			mA
Ripple rejection	f = 400 Hz,	IOUT2 = 100 mA		50		dB

LDO regulator 3 (TCX0), T_A = –30°C to 85°C

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Output voltage VOUT3	IOUT3 = 1 mA to 3 mA,	V_{CC} = 3.3 V to 4.2 V, EN1 = 3 V	2.825	3	3.175	V
Dropout voltage	IOUT3 = 3 mA				100	mV
Maximum current	V_{CC} = 3.75 V,	VOUT3 = 2.85 V	5			mA
Current limit	VOUT3 shorted to GND		7.5			mA
Ripple rejection	f = 400 Hz,	IOUT3 = 3 mA		60		dB

LDO regulator 4 (Audio), T_A = –30°C to 85°C

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Output voltage VOUT4	IOUT4 = 5 mA to 40 mA,	V_{CC} = 3.3 V to 4.2 V, EN1 = 3 V	2.825	3	3.175	V
Dropout voltage	IOUT4 = 40 mA				250	mV
Maximum current	V_{CC} = 3.75 V,	VOUT4 = 2.85 V	75			mA
Current limit	VOUT4 shorted to GND		112			mA
Ripple rejection	f = 400 Hz,	IOUT4 = 30 mA		60		dB

electrical characteristics over recommended operating junction temperature range, V_{CC} = 3.75 V and VEXT = 5.5 V (unless otherwise specified) (continued)

LDO regulator 5 (RX), T_A = –30°C to 85°C

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output voltage VOUT5	IOUT5 = 10 mA to 30 mA, V_{CC} = 3.3 V to 4.2 V, EN1 = 3 V	2.825	3	3.175	V
Dropout voltage	IOUT5 = 20 mA			250	mV
Maximum current	V_{CC} = 3.75 V, VOUT5 = 2.85 V	40			mA
Current limit	VOUT5 shorted to GND	60			mA
Ripple rejection	f = 400 Hz, IOUT5 = 20 mA		60		dB

LDO regulator 6 (TX), T_A = –30°C to 85°C

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output voltage VOUT6	IOUT6 = 30 mA to 70 mA, V_{CC} = 3.3 V to 4.2 V, EN1 = 3 V	2.825	3	3.175	V
Dropout voltage	IOUT6 = 50 mA			250	mV
Maximum current	V_{CC} = 3.75 V, VOUT6 = 2.85 V	70			mA
Current limit	VOUT6 shorted to GND	105			mA
Ripple rejection	f = 400 Hz, IOUT6 = 50 mA		60		dB

LDO regulator 7 (PLL), T_A = –30°C to 85°C

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output voltage VOUT7	IOUT7 = 10 mA to 25 mA, V_{CC} = 3.3 V to 4.2 V, EN1 = 3 V	2.825	3	3.175	V
Dropout voltage	IOUT7 = 20 mA			250	mV
Maximum current	V_{CC} = 3.75 V, VOUT7 = 2.85 V	30			mA
Current limit	VOUT7 shorted to GND	45			mA
Ripple rejection	f = 400 Hz, IOUT7 = 20 mA		60		dB
Output noise voltage (RMS)	BW = 300 Hz – 50 kHz			100‡	μV

† With external filtering

VDET1, T_A = 25°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{CH}	Threshold voltage of CH		2.85	3	3.15	V
	Hysteresis voltage of CH			100		mV
VODET1	Output voltage	VCH > THRESHOLDV		0	0.3	V
VODET2	Output voltage	VCH < THRESHOLDV		VOUT2	0.3	V
TCDET1	Temp. coefficient of VODET1			±100		ppm/°C

electrical characteristics over recommended operating junction temperature range, V_{CC} = 3.75 V and VEXT = 5.5 V (unless otherwise specified) (continued)

VDET2, T_A = 25°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
	Threshold voltage of VCC		2.85	3	3.15	V
	Hysteresis voltage of VCC			100		mV
VODET1	Output voltage	VCH > THRESHOLDV		0	0.3	V
VODET2	Output voltage	VCH < THRESHOLDV		VOUT2		V
TCDET2	Temperature coefficient of VDET2			±100		ppm/°C
TDELAY2	Delay of VDET2	Cdet_delay = 0.1 µF	35	50	75	ms

power switch, T_A = 25°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
VSUP	Output voltage	ISUP = 0 mA – 50 mA, V_{CC} = 3.75 V	3.45	3.60	3.75	V
V_{ON}	On voltage	V_{CC} = 3.3 V – 5 V, ISUP = 30 mA			300	mV
I_{MAX}	Maximum current	V_{CC} = 3.75 V ,VSUP = 0 V			200	mA
I_{MIN}	Minimum current	V_{CC} = 3.75 V, VSUP = 3.45 V	70			mA

analog multiplexer, T_A = –30°C to 85°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
	Sine-wave distortion	1 kHz, 1 Vpp, 1.5 VDC offset		0.1%		
FMAX	Frequency response (switch on)	–3 dB gain	1			MHz
	Feed-through attenuation (switch off)	f = 250 kHz			–40	dB
	Crosstalk (control input to signal output)	Tr = Tf = 50 ns			100	mV
	Crosstalk (between switches)	f = 250 kHz			–50	dB
DC CHARACTERISTICS						
R_{ON}	On resistance			700	1200	Ω
ΔR_{ON}	Difference of ON resistance between switches			10		Ω
I_{OFF}	Input/output leakage current				±400	nA
I_Z	Switch input leakage current				±400	nA
I_{IN}	Control-input current				±1	µA
Iq	Quiescent current				10	µA
AC CHARACTERISTICS						
	Phase difference between input and output	1 kHz (spec is flexible, dependent on the design)			50	ns
	Output enable time tpzl, tpzh				100	ns
	Output disable time tplz, tphz				150	ns
C_{IN}	Control input capacitance	All pins			10	pF
C_{IOS}	Input terminal capacitance				15	pF
C_{IS}	Output terminal capacitance				50	pF
C_{IOS}	Feed-through capacitance				2	pF

electrical characteristics over recommended operating junction temperature range, V_{CC} = 3.75 V and VEXT = 5.5 V (unless otherwise specified) (continued)

operational amplifiers, T_A = –30°C to 85°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{OS}	Input offset voltage	Vcm = 1.5 V		2	10	mV
I_{OPB}	Input bias current			50	250	na
I_{OPOS}	Input offset current			5	50	nA
R_{IN}	Input resistance	DC resistance		100		MΩ
CMMR	Common-mode rejection ratio	f = 400 Hz, Vcm = 1.5 V	65	75		dB
VCM	Input common voltage		0.1		2.9	V
PSRR	Power-supply rejection ratio	f = 400 Hz, Vcm = 1.5 V	60	70		dB
C_{IN}	Common-mode input capacitance			3		pF
V_O	Output swing, high	Output high, I_O = 2.5 mA (source)	2.9	2.95		V
	Output swing, low	Output low, I_O = –2.5 mA (sink)		0.1	0.15	V
I_O	Output current	DC Current			±2.5	mA
THD	Total harmonic distortion	f = 1 kHz, 20 dB closed-loop gain, I_O = 0.5 mA		1%		
SR	Slew rate			0.3†		V/µs
GBW	Gain bandwidth product			300		kHz

ringer driver, T_A = –30°C to 85°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
R_{ON}	On resistance	RINGON = V_{CC}, IOUTRING = 100 mA, T_A = 25°C			3	Ω
TONRING	Turnon time				10	µs
TOFFRING	Turnoff time				10	µs

internal power supply

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
VINTERNAL	Output voltage	ILOAD = 7.5 mA	3.1	3.25	3.4	V

bandgap reference

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
	Output voltage		1.1812	1.192	1.2028	V
	Output noise voltage (RMS)	BW = 300 Hz – 50 kHz			800	nV/Hz
REFVALID	Reference valid			5		µA

thermal shutdown

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Trip point		160		190	°C
Hysteresis temperature			15		°C

THERMAL INFORMATION

The implementation of integrated circuits in low-profile and fine-pitch surface-mount packages requires special attention to power dissipation. Many system-dependent issues such as thermal coupling, airflow, added heat sinks and convection surfaces, and the presence of other heat-generating components affect the power-dissipation limits of a given component.

Three basic approaches for enhancing thermal performance are listed below.

- Improving the power dissipation capability of the printed-circuit board design
- Improving the thermal coupling of the component to the printed-circuit board
- Introducing airflow into the system

Using the given $R_{\theta JA}$ for this device, the maximum power dissipation can be calculated with the equation:

$$P_{D(MAX)} = \frac{T_{J(MAX)} - T_A}{R_{\theta JA}}$$

APPLICATION INFORMATION

capacitor selection

The output bypass capacitor of each LDO regulator should be selected from the list of ceramic capacitors shown below. The VCC bypass capacitors should be selected from the list of tantalum capacitors shown below. Tantalum capacitors have good temperature stability and offer good capacitance for their size. Care should be taken when using marginal quality tantalum capacitors, as the increase of the equivalent series resistance (ESR) at low temperatures can cause instability. For a given capacitance, ceramic capacitors are usually larger and more costly than tantalums. The capacitance of ceramic capacitors varies greatly with temperature. In addition, the ESR of ceramic capacitors can be low enough to cause instability. A low-value resistor can be added in series with the ceramic capacitor to provide a minimum ESR.

ceramic (X7R or X5R)

CAPACITANCE	CASE SIZE	ESR (MAX)
1 µF	0805	3.8 mΩ
2.2 µF	0805	4.5 mΩ
3.3 µF	0805	4.1 mΩ
2.2 µF	1206	3.4 mΩ
4.7 µF	1206	1.9 mΩ

tantalum (6.3 V rating)

CAPACITANCE	CASE SIZE	ESR (MAX)
4.7 µF	A(3216)	6 Ω
6.8 µF	A(3216)	6 Ω
10 µF	A(3216)	4 Ω
10 µF	P(0805)	6 Ω

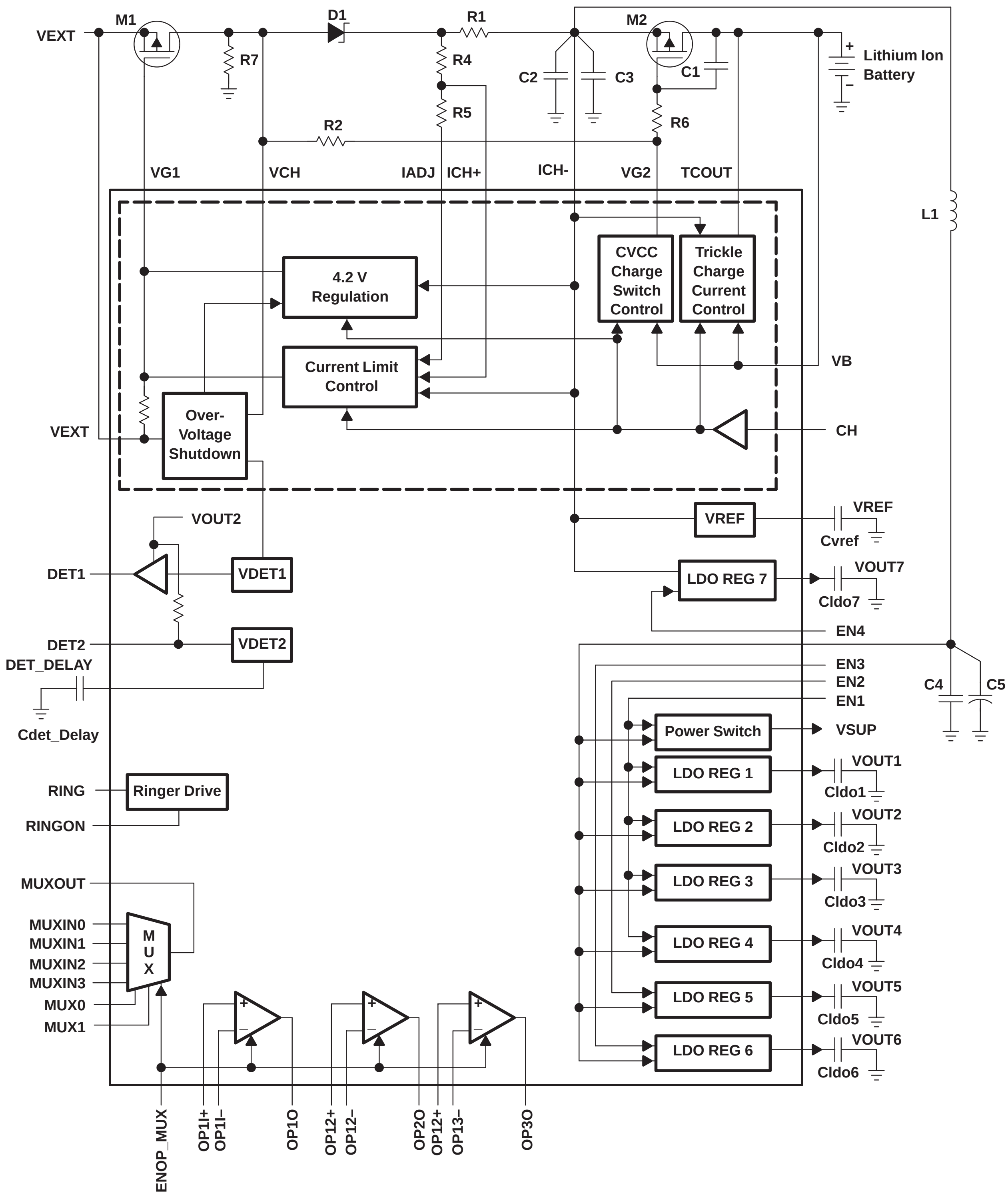
APPLICATION INFORMATION

recommended parts list

REFERENCE	DESCRIPTION	MANUFACTURER	VALUE	PART NUMBER
C1	Ceramic, 0805, X7R		100 pF	
C2	Ceramic, 0805, X7R		0.01 µF	
C3	Tantalum, 6.3 V, Case B, 20%	Siemens Matsushita	10 µF	B 45 196-E1106-M20
C4	Ceramic, 0805		0.01 µF	
C5	Tantalum, 6.3 V, Case B, 20%	Siemens Matsushita	10 µF	B 45 196-E1106-M20
Cldo1	Ceramic, 0805, X7R		0.22 µF	
Cldo2	Ceramic, 10 V, 1206, X5R, 20%	Taiyo Yuden	4.7 µF	LMK316BJ475ML
Cldo3	Ceramic, 0805, X7R		0.22 µF	
Cldo4	Ceramic, 10 V, 1206, X5R, 20%	Taiyo Yuden	3.3 µF	LMK316BJ335ML
Cldo5	Ceramic, 16 V, 0805, X5R, 20%	Taiyo Yuden	2.2 µF	LMK212BJ225MG
Cldo6	Ceramic, 10 V, 1206, X5R, 20%	Taiyo Yuden	4.7 µF	LMK316BJ475ML
Cldo7	Ceramic, 16 V, 0805, X5R, 20%	Taiyo Yuden	2.2 µF	LMK212BJ225MG
Cvref	Ceramic, 0805, X7R		1000 pF	
Cdet_delay	Ceramic, 0805, X7R		0.1 µF	
D1	Schottky diode	Rohm		RB051L-40
L1			1 µH	
M1		Siliconix Fairchild		Si3455DV FDC654P
M2		Siliconix Siliconix Siliconix Fairchild		Si3441DV Si3443DV Si2305DS FDC634P
R1	1/4 W, 5%		0.1 Ω	
R2	0805, 1/10 W, 5%		10 kΩ	
R3	0805, 1/10 W, 5%		1 kΩ	
R4	0805, 1/10 W, 5%		560 Ω	
R5	0805, 1/10 W, 5%		6.8 kΩ	
R6	0805, 1/10 W, 5%		2.7 Ω	
R7	0805, 1/10 W, 5%		10 kΩ	

APPLICATION INFORMATION

battery charging control



APPLICATION INFORMATION

battery-charging control (continued)

The battery-charging control block in the device is a part of the Li-Ion battery charging system of the phone. The device controls the P-channel MOSFET to accomplish constant-voltage/constant-current charging (CVCC) within a ±1% tolerance in the charging termination voltage.

The battery charging control consists of the two sections:

- CVCC charge-switch control with feedback loops for voltage and current control
- Trickle charge-current control

When the voltage-detector output (DET1) is set high, the voltage-control loop is activated to regulate the voltage of ICH- to 4.2 V. Then, when the control signal input CH is set high, either the current-control loop or the trickle-charge control block is activated, depending upon battery voltage.

When VB is below the threshold Vtc, the trickle-charge current control block directs the current to the battery via TCIN, trickle-charging current control, TCOUT, R6, and the battery. The measure of the voltage across sense resistor R6 is used for feedback-control of the rate of charging current.

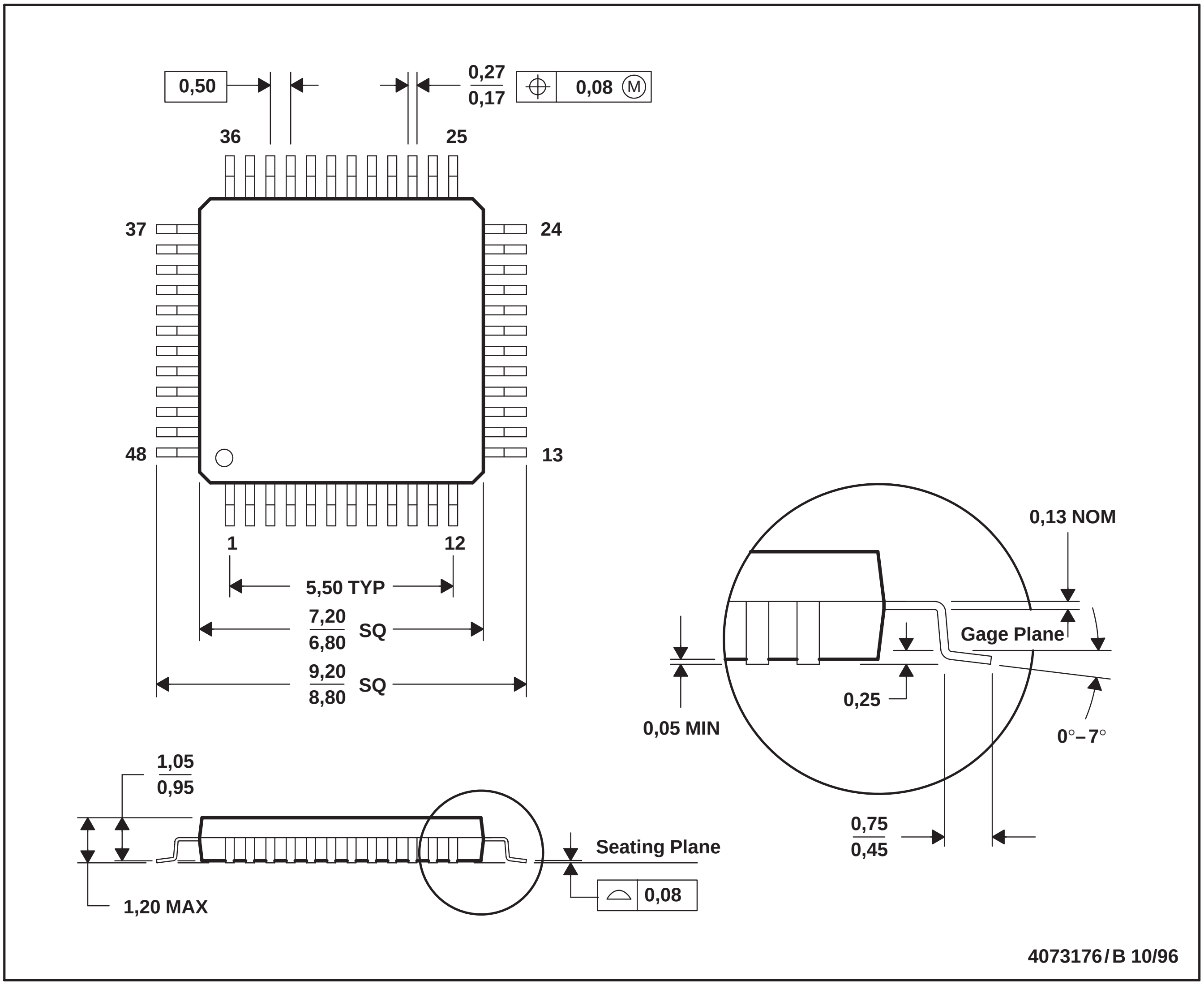
Once the battery voltage reaches the threshold Vtc, the CVCC charge-switch control block becomes active and controls the P-channel MOSFET M1. The feedback control ensures that the voltage ICH- does not exceed 4.2 V ± 0.05 V (4.2 V regulation), and the current draw of resistor R1 does not exceed the specified value (current-limit control). In this case, the charging current drains via R1, M2, and the battery. The maximum charging current is set by external resistors for design flexibility.

analog multiplexer output table

MUX1	MUX2	OUTPUT
0	0	MUXIN0
0	1	MUXIN1
1	0	MUXIN2
1	1	MUXIN3

MECHANICAL DATA

PFB (S-PQFP-G48) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-026

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