Large Current External FET Controller Type Switching Regulators

Single-output High-frequency Step-down Switching Regulator(Controller type)
BD9850FVM

Dual-output Step-up, Negative, Step-down Switching Regulator(Controller type)
BD9851EFV

● Description

The BD9850FVM is a 1-channel DC/DC step-down switching regulator controller, while the BD9851EFV is a 2-channel DC/DC step-down switching regulator controller. The BD9850FVM is adaptable for a maximum switching frequency of 2 MHz and the BD9851EFV for that of 3 MHz. Both provide space saving in all applications.

● Features

1) Adaptable for 2-MHz switching frequency (externally variable) (BD9850FVM)

Adaptable for 3-MHz switching   frequency (externally variable) (BD9851EFV)

2) FET direct drive

3) High-accuracy reference voltage (Accuracy: ±1%)

4) Built-in Under Voltage Lock Out circuit (UVLO)

5) Built-in Thermal Shutdown circuit (TSD)

6) The BD9851EFV provides two channels:

Channel 1 available for selection of step-down/step-up switching

Channel 2 available for selection of step-down/inverting switching.

7) Compact MSOP8 package (BD9850FVM) / HTSSOP-B20 package (BD9851EFV)

● Applications

TFT panel, TA / Router, digital consumer electronics, PC, and portable CD/DVD/DVC

● Product lineup

	BD9850FVM	BD9851EFV
Input range	4V to 9V	4V to 18V
Oscillation frequency range	100kHz to 2MHz	10kHz to 3MHz
External synchronization	Not provided	Not provided
Standby function	Not provided	Provided
Operating temperature	−40℃ to 85℃	−40℃ to 85℃
Package	MSOP8	HTSSOP-B20

Sep. 2008

ROHM CO.,   LTD .

● **Absolute maximum ratings** (Ta=25˚C)

○ BD9850FVM

Item	Symbol	Rating	Unit
Power supply voltage	Vcc	10	V
Storage temperature	Tstg	−55 to +150	ºC
Operating temperature	Topr	−40 to +85	ºC
Power dissipation	Pd	587 *	mW
Maximum junction temperature	Tjmax	+150	ºC

*Reduce by 4.7 mW/ºC over 25ºC (When mounted on PCB of 70mm×70mm×1.6mm)

○ BD9851EFV

Item	Symbol	Rating	Unit
Power supply voltage (Between Vcc and GND)	Vcc	20	V
Between V_{REF} and GND	V_{REF}	7	V
Between OUT1 and PVcc1 Between OUT2 and PVcc2	Vouth	20	V
Between OUT1, OUT2 and PGND	Voutl	20	V
Power dissipation	Pd	1000 (*)	mW
Operating temperature	Topr	−40 to +85	ºC
Maximum junction temperature	Tjmax	+150	ºC
Storage temperature	Tstg	−55 to +150	ºC

(*)Reduce by 8.0 mW/ºC over 25ºC (When mounted on PCB of 70mm×70mm×1.6mm)

● **Recommended operating range**

○ BD9850FVM

Item	Symbol	Limits			Unit
		min.	Typ.	max.	
Power supply voltage	Vcc	4	7	9	V
Oscillation frequency	fosc	100	–	2000	kHz
Operating temperature	Topr	−40	–	+85	ºC

○ BD9851EFV

Item	Symbol	Limits			Unit
		min.	Typ.	max.	
Power supply voltage	Vcc	4	12	18	V
Oscillation frequency	fosc	10	300	3000	kHz
Timing resistor	R_{RT}	3.3	–	47	kΩ
Timing capacitor	C_{CT}	33	–	10000	pF

◎ BD9850FVM

Electrical characteristics (Unless otherwise specified, Ta=25℃, Vcc=7V, fosc=600kHz)

Item	Symbol	Limits			Unit	Conditions
		min.	Typ.	max.		
[Oscillator block]						
Oscillation frequency	fosc	510	600	690	kHz	R_{RT} = 24kΩ
Frequency regulation	FDV	−5	0	5	%	Vcc = 4V to 9V
Oscillator amplitude voltage	Vpptr	–	0.5	–	V	*
[Soft start / SW block]						
CTL / SS pin sink current	ISS	−1.90	−1.00	1.00	μA	$V_{CTL/SS}$ = 1.5V
CTL / SS pin clamp voltage	VSS	2.2	2.4	2.6	V	
CTL threshold voltage	VCTLTH	1.2	1.3	1.4	V	
[PWM comparator block]						
0% threshold voltage	D0	1.5	1.6	1.7	V	fosc = 600kHz
100% threshold voltage	D100	2.0	2.1	2.2	V	fosc = 600kHz
[Error Amp block]						
Threshold voltage	V_{IN}	0.98	1.00	1.02	V	AV = 0dB *
Frequency bandwidth	BW	1.5	3.0	–	MHz	*
Voltage gain	Av	–	70	–	dB	
Input bias current	IIB	−150	−70	–	hA	
Maximum output voltage	VCH	2.3	2.4	2.6	V	
Minimum output voltage	VCL	–	0.03	0.20	V	
Output source current	IOl	−3.1	−1.6	−1.0	mA	V_{FB} = 1.0V
Output sink current	IOO	12	50	125	mA	V_{FB} = 1.0V
[V_{REF} block]						
V_{REF} output voltage	V_{REF}	2.475	2.500	2.525	V	I_{VREF} = 0mA
F_{REF} load regulation	ΔV_{REFI0}	–	–	10	mV	I_{VREF} = 0mA to −1mA
V_{REF} current capacitance	I_{VREF}	−45	−16	−1	mA	
[Total device]						
Standby current	ICCS	420	610	960	μA	
Average supply current	ICCA	3.4	5.0	7.8	mA	At no load
[Output block]						
ON resistance	R_{ON}	0.9	2.5	8.0	Ω	
Output transient time	Tr/Tf	–	20	–	nsec	Cout = 1000pF *
[Under voltage lockout block]						
Threshold voltage	VUT	3.7	3.8	3.9	V	Vcc sweep down
Hysteresis width	VUThy	0.05	0.10	0.15	V	

*Design guarantee
*Not designed to be radiation-resistant.

◎ BD9851EFV

Electrical characteristics (Unless otherwise specified, Ta=25℃, Vcc=12V, fosc=300kHz, STB=3V)

Item	Symbol	Limits min.	Typ.	max.	Unit	Conditions
[Total device]						
Standby mode circuit current	Iccst	–	–	5	µA	STB=0V
Operation mode circuit current	Icc	1.5	2.5	4.1	mA	FB1, FB2=0V
[Reference voltage block]						
Output voltage	V_{REF}	2.475	2.500	2.525	V	Io=−0.1mA
Input stability	DVli	–	–	10	mV	Vcc=4Vto18V, Io=−0.1mA
Load stability	DVlo	–	–	10	mV	Io=−0.1mA to −1mA
Short circuit mode output current	Ios	−45	−12	−3	mA	
[Oscillator block]						
Oscillation frequency	fosc	270	300	330	kHz	R_{RT}=24kΩ, C_{CT}=220pF
Oscillation frequency regulation	Dfosc	−2	0	2	%	Vcc=4Vto18V
[Error Amp block]						
Threshold voltage	Vthea	0.98	1.00	1.02	V	Ch1
Input offset voltage	Vofst	−10	0	10	mV	Ch2
Common-mode input voltage range	Vcm	0.3	–	2.0	V	Ch2
Input bias current	Ibias	−150	−70	–	nA	
Voltage gain	Av	60	75	90	dB	DC *Design guarantee
Frequency bandwidth	Bw	3	6	13	MHz	MHz *Design guarantee
Maximum output voltage	Vfbh	V_{REF}−0.1	–	V_{REF}	V	
Minimum output voltage	Vfbl	–	–	0.1	V	
Output sink current	Isink	1.6	6	16	mA	FB pin
Output source current	Isource	−260	−160	−90	µA	FB pin
[PWM comparator block]						
0% threshold voltage	Vth0	1.21	1.31	1.41	V	FB voltage
100% threshold voltage	Vth100	1.74	1.84	1.94	V	FB voltage
DTC bias current	Idtc	−1	–	1	µA	
[FET driver block]						
ON resistance	R_{ONN}	1.5	3	3	Ω	When OUT=Lo
	R_{ONP}	1	2	2	Ω	When OUT=Hi
SEL1 input voltage range	Vselh	Vcc−0.2	–	–	V	In step-down switching
	Vsell	0	–	–	V	In step-down switching
[Control block]						
Threshold voltage	Vstb	0.6	1.5	1.5	V	
Sink current	Istb	6	15	15	µA	STB=3V
[Short circuit protection circuit (SCP) block]						
Timer start voltage	Vtime	2.2	2.3	2.3	V	FB voltage
Threshold voltage	Vthscp	1.4	1.5	1.5	V	SCP voltage
Standby mode voltage	Vstscp	–	10	10	mV	SCP voltage
Source current	Vsoscp	−3.2	−2.0	−2.0	µA	SCP=0.75V
[Under voltage lockout block (UVLO)]						
Threshold voltage	Vuvlo	3.58	3.7	3.7	V	Vcc sweep down
Hysteresis width	DVuvlo	0.05	0.11	0.11	V	

*Design guarantee
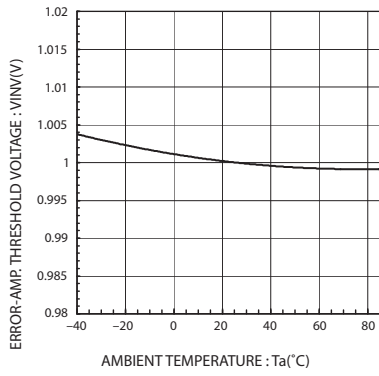
● Characteristic data
  (BD9850FVM)

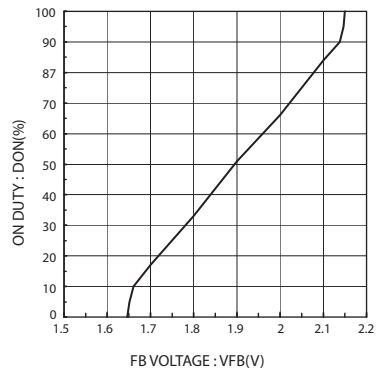Fig.1 Error Amp threshold voltage vs. Ambient temperature
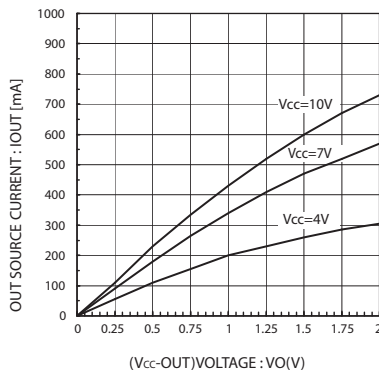

Fig.2 FB voltage vs. ON Duty
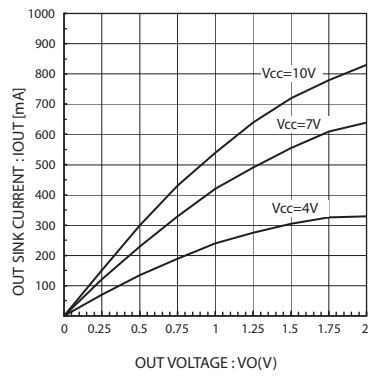

Fig.3 (Vcc-OUT) Voltage vs. Output source current

Fig.4 Output voltage vs. Output sink current
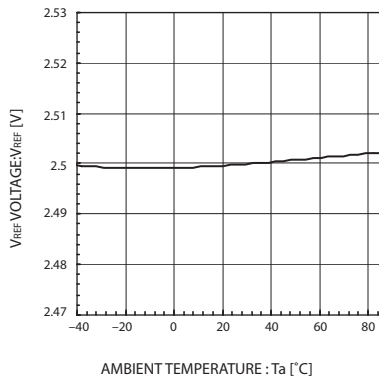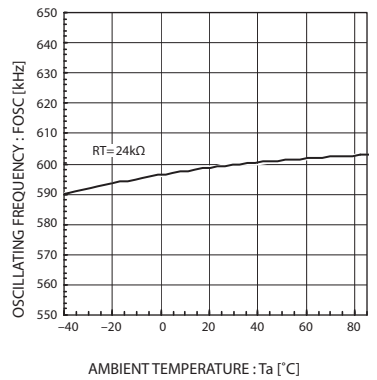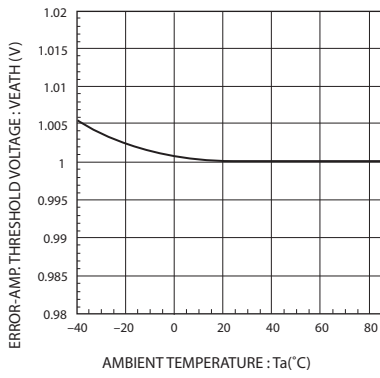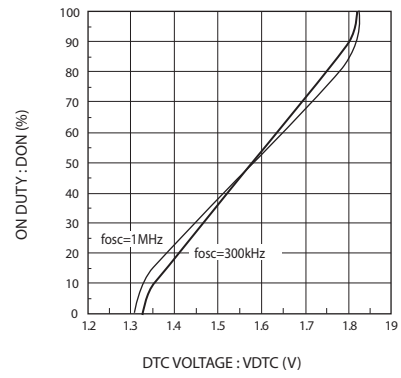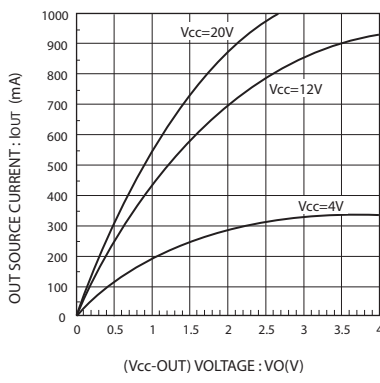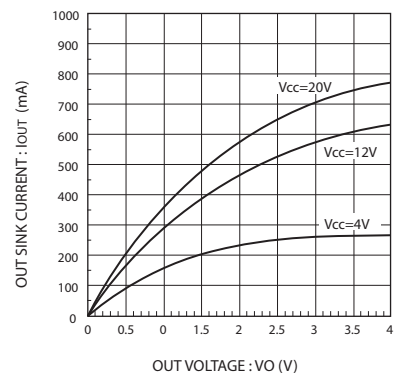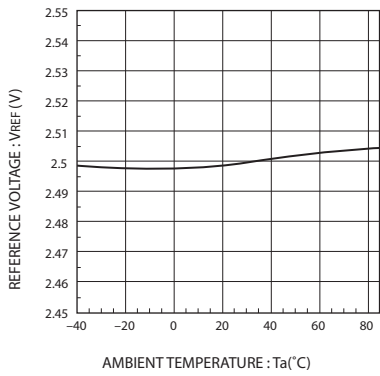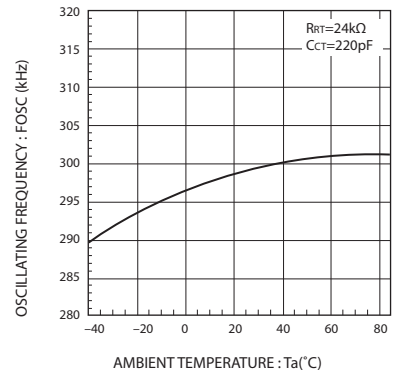

Fig.5 VREF vs. Ambient temperature

Fig.6 Oscillation frequency vs. Ambient temperature

Fig.7 Error Amp threshold voltage vs. Ambient temperature

Fig.8 FB voltage vs. ON Duty

Fig.9 (Vcc-OUT) Voltage vs. Output source current

Fig.10 Output voltage vs. Output sink current

Fig.11 VREF vs. Ambient temperature

Fig.12 Oscillation frequency vs. Ambient temperature

● Block diagram / Pin assignment

(BD9850FVM)
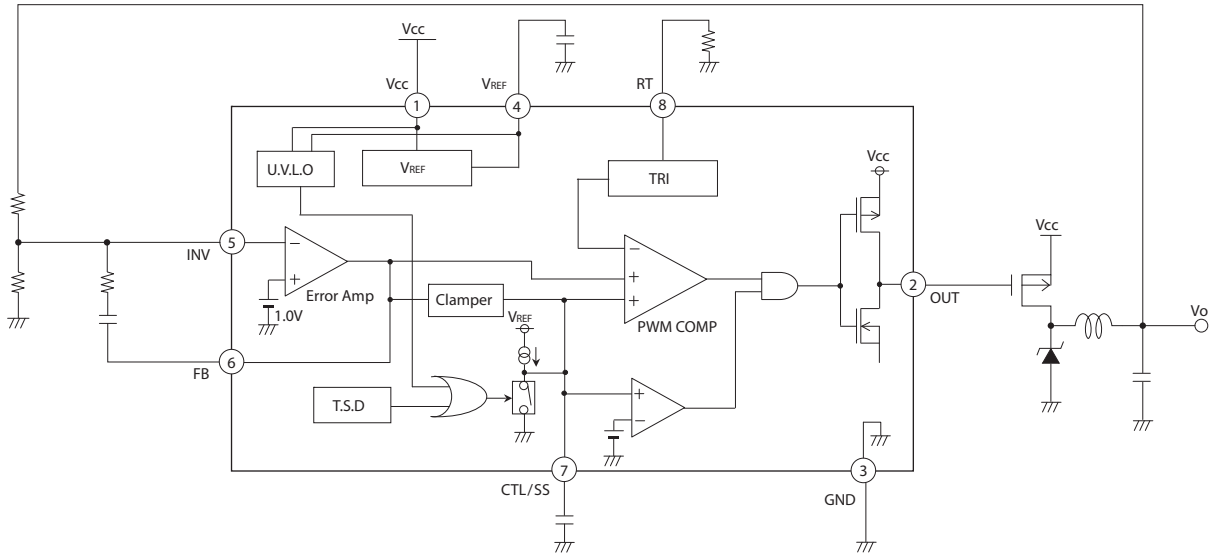
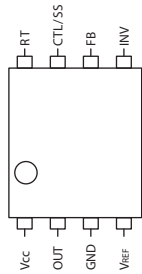Fig.13 BD9850FVM Block diagram

Pin No.	Pin name	Function
1	Vcc	Power supply
2	OUT	FET driver drive output
3	GND	Ground
4	VREF	Reference voltage (2.5V±1%) output
5	INV	Error Amp inverting input
6	FB	Error Amp output
7	CTL/SS	Control/Soft start common
8	RT	Oscillation frequency setting resistor connection

(BD9851EFV)
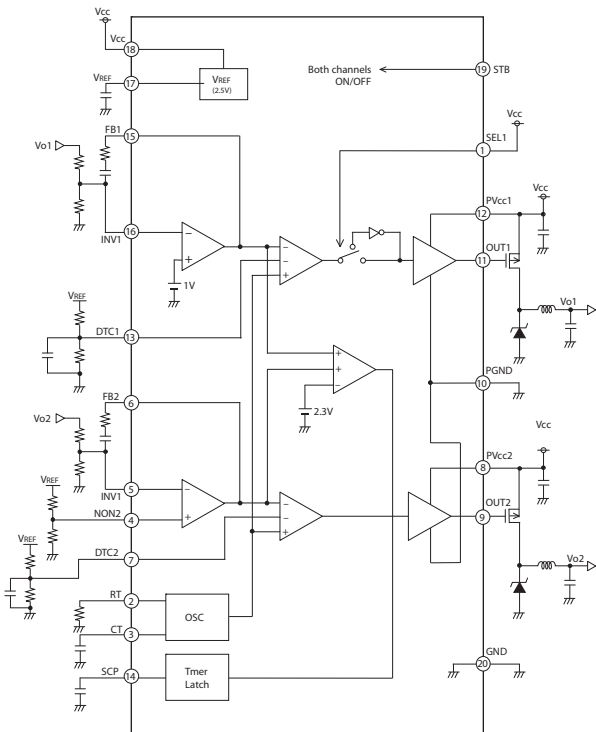
Fig.14 BD9851EFV Block diagram
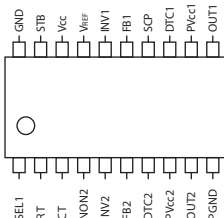
Pin No.	Pin name	Function
1	SEL1	CH1 drive FET setting (Vcc short: P-ch drive, GND short: N-ch drive)
2	RT	Oscillation frequency setting resistor connection
3	CT	Oscillation frequency setting capacitor connection
4	NON2	Error Amp non-inverting input (CH2)
5	INV2	Error Amp inverting input (CH2)
6	FB2	Error Amp output (CH2)
7	DTC2	Maximum duty/soft start setting (CH2)
8	PVcc2	FET driver block power supply input (CH2)
9	OUT2	FET driver block output (CH2)
10	PGND	FET driver block ground
11	OUT1	FET driver block output (CH1)
12	PVcc1	FET driver block power supply input (CH1)
13	DTC1	Maximum duty/soft start setting (CH1)
14	SCP	Short circuit protection timer setting capacitor connection
15	FB1	Error Amp output (CH1)
16	INV1	Error Amp inverting input (CH1)
17	VREF	Reference voltage (2.5V±1%) output
18	Vcc	Power supply input
19	STB	ON/OFF control
20	GND	Ground
–	FIN on reverse	Make FIN on the reverse open or ground to GND (pin 20) (However, open FIN on the reverse will degrade radiation performance.)

●Description of operations

1) Reference voltage block
   The reference voltage block generates a constant voltage with temperature compensated through inputting the power supplied from the Vcc pin. The output voltage is 2.5 V, with a ±1% accuracy. To cancel noises, insert a capacitor with a low ESR (several tens of mΩ) between the VREF and GND pins. It is recommended to use a ceramic capacitor of 1μF for this purpose.

2) Triangular wave oscillator block
   By connecting the resistor and capacitor of frequency settings to the RT and CT pins (only to RT pin on the BD9850FVM), a triangular wave will be generated and then input to the PWM comparators of Channels 1 and 2.

3) Error Amp block
   The Error Amp block detects the output voltage of the INV pin, amplifies an error with the set output voltage, and then outputs the error from the FB pin. The comparison voltage is 1 V, with a ±2% accuracy. (The Channel 2 of the BD9851EFV uses the NON pin input voltage as a reference.)
   Inserting a resistor and capacitor between the INV and FB pins will conduct phase compensation.

4) PWM comparator block
   The PWM comparator block converts the output voltage (FB voltage) into a PWM waveform and outputs it to the FET driver.
   <Dead time control> (Only available on the BD9851EFV)
    Inputting a voltage, divided by resistance of the VREF pin in the DTC pin, will allow maximum ON duty setting.
   <Soft start (BD9850FVM)>
    Inserting a capacitor between the CTL/SS and GND pins will allow the soft start function to control the rising output voltage.
   <Soft start (BD9851EFV)>
    Inserting a capacitor between the DTC and GND pins will allow the soft start function to control the rising output voltage. Furthermore, the overshoot of output voltage at startup can be derated. Adding a Schottky diode between the FB and DTC pins will make it possible to suppress the overshoot rate (only available with step-down application).

5) FET driver block
   This block is a push-pull type driver enabling direct drive of external MOS FET.
   <Setting of step-down/step-up switching (Only available for Channel 1 of BD9851EFV)>
    For the Channel 1, SEL1 pin setting will determine the application function.
    Set the SEL1 pin to step-down (P-ch drive) mode for short-circuiting Vcc or to step-up (N-ch drive) mode for short-circuiting GND.
    Furthermore, be sure to short-circuit the SEL1 pin to Vcc or GND pin.

6) Standby function
   (BD9850FVM)
    The CTL/SS pin allows for output ON/OFF control. Set the CTL/SS pin voltage to "H" to activate the output ON control.
   (BD9851EFV)
    The STB pin allows for output ON/OFF control. Set the STB pin voltage to "H" to activate the output ON control.
    The standby mode circuit current should be set to less than 5 μA.

7) Short circuit protection circuit (SCP) (Only available on BD9851EFV)
   The SCP is a timer-latch type short circuit protection circuit.
   If the output voltage of either channel drops below the set voltage, the Error Amp will be activated to increase the FB voltage and initiate charging the capacitor connected to the SCP pin with a 2 μA current. When the SCP pin voltage exceeds 1.5 V, the latch circuit will be activated to fix the output of both channels at OFF and, at the same time, the DTC pin at "L" level.
   In order to rest the latch circuit, set the STB pin to "L" level once, and then to "H" level. Or, turn ON the power supply again.
   Furthermore, if the short circuit protection circuit is not used, short-circuit the SCP pin to the GND pin.

8) Under Voltage Lock Out (UVLO) circuit
   The UVLO is a protection circuit to prevent the IC from malfunctioning when the power supply turns ON or if an instantaneous power interruption occurs.
   When the Vcc voltage falls below 3.8 V (or 3.7 V on the BD9851EFV), the output of both channels will be fixed at "OFF" and, at the same time, the DTC pin at "L" level. Hysteresis width of 0.1 V (or 0.11 V on the BD9851EFV) is provided for the detection voltage and release voltage of the UVLO in order to prevent malfunctions of the IC which may result from variations in the input voltage due to threshold online.
   Furthermore, if the latch circuit is activated through the short circuit protection circuit, the circuit will be reset by this UVLO.

9) Thermal shutdown circuit (TSD)
   The TSD is a protection circuit to prevent the destruction of the IC due to abnormal heat generation.
   If the TSD detects an abnormal heat generation (175°C) on the chip, the output of both channels will be fixed at "OFF" and, at the same time, the DTC pin at "L" level. Hysteresis width (15°C) is provided for the superheat detection and release temperatures in order to prevent malfunctions of the IC which may result from variations in the input voltage due to threshold online.
   Furthermore, if the latch circuit is activated through the short circuit protection circuit, the circuit will be reset by this TSD.

● Timing chart
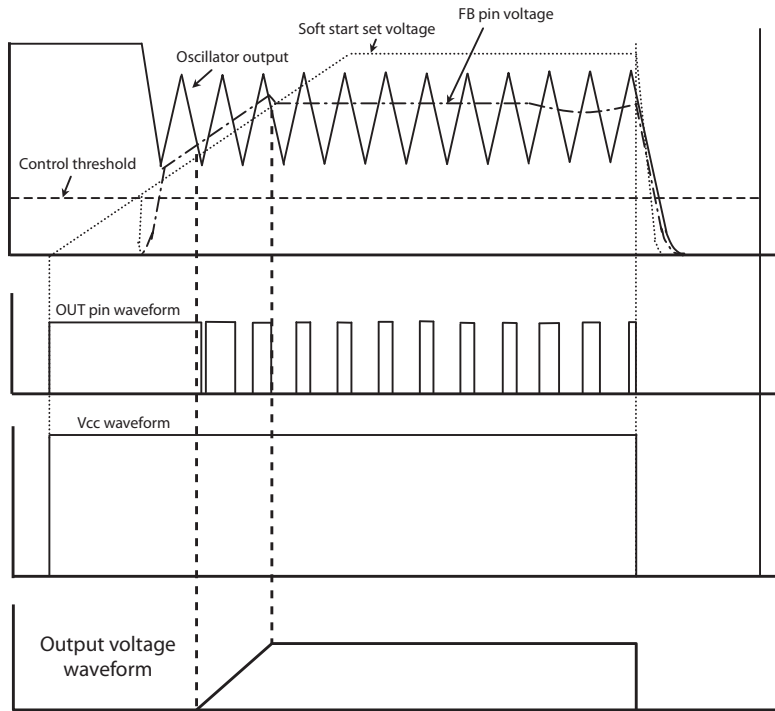
• In startup/normal operation
(BD9850FVM)

Soft start set voltage
FB pin voltage
Oscillator output
Control threshold
OUT pin waveform
Vcc waveform
Output voltage
waveform

Fig.15 BD9850FVM Timing chart

(BD9851EFV)

Vcc pin voltage
waveform
3.8V

Output short circuit
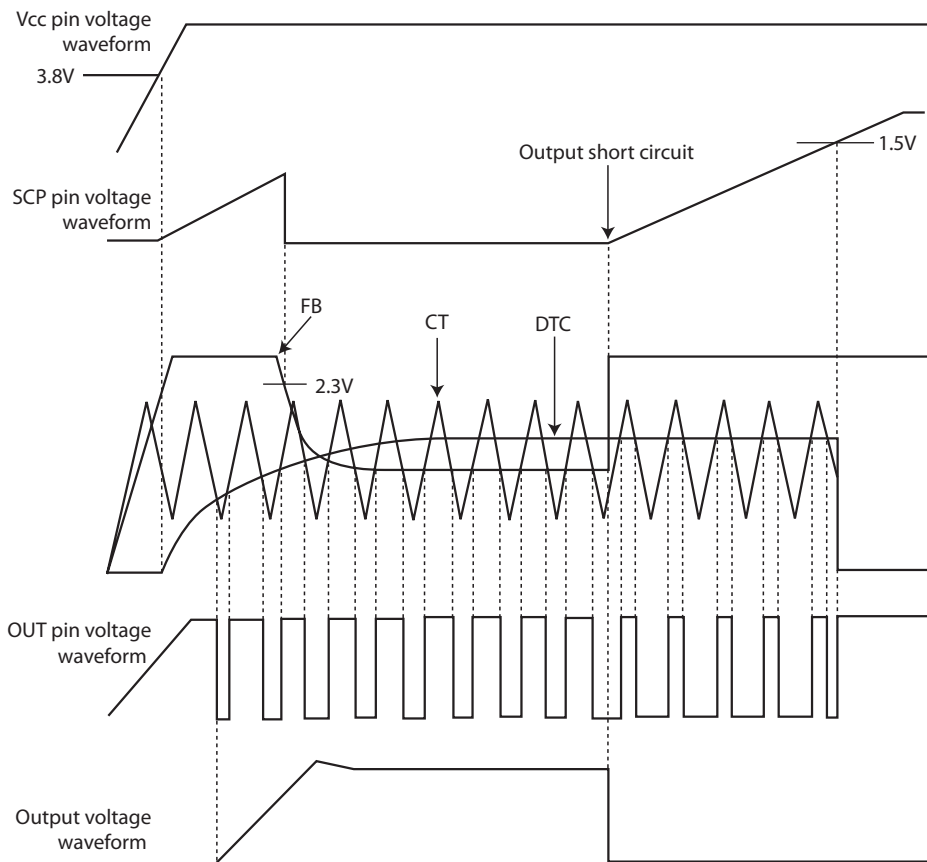1.5V

SCP pin voltage
waveform
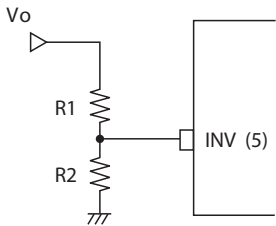
FB
CT
DTC
2.3V

OUT pin voltage
waveform

Output voltage
waveform

Fig.16 BD9851EFV Timing chart
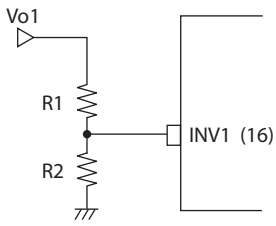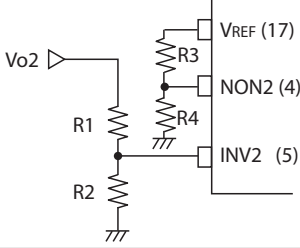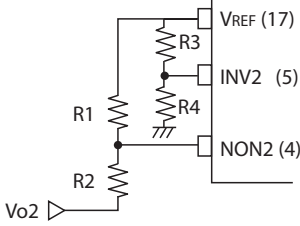
● Description of external components

• Setting of output voltage (BD9850FVM)
  Setting of output voltage for the step-down application can be calculated by the formula below :

Setting procedure	Application
$Vo = Vthea \times (R1 + R2) / R2$ [V] (Vthea: Error Amp threshold voltage Typ. 1.0 [V])	Vo R1 R2 INV (5)

● Setting of output voltage (BD9851EFV)

Setting procedure	Application
• Step-down (CH1), Step-up (CH1) $Vo1 = Vthea \times (R1 + R2) / R2$ [V] (Vthea: Error Amp threshold voltage Typ. 1.0 [V])	Vo1 R1 R2 INV1 (16)
• Step-down (CH2) $Vo2 = V_{NON}2 \times (R1 + R2) / R2$ [V] $V_{NON}2 = 2.5 \times R4 / (R3 + R4)$ [V] However, set the NON2 pin voltage to 0.3 to 2.0 V.	Vo2 VREF (17) R3 NON2 (4) R1 R4 INV2 (5) R2
• Inverting (CH2) $Vo2 = 2.5 - \{(2.5 - V_{INV}2) \times (R1 + R2) / R1\}$ [V] $V_{INV}2 = 2.5 \times R4 / (R3 + R4)$ [V] However, set the INV2 pin voltage to 0.3 to 2.0 V	VREF (17) R3 INV2 (5) R1 R4 NON2 (4) R2 Vo2

● Setting of oscillation frequency (BD9850FVM)
  Connecting a resistor to the RT pin (pin 2) allows for the setting of oscillation frequency.

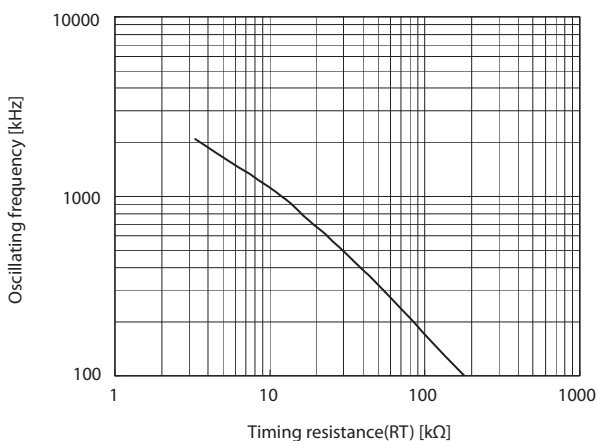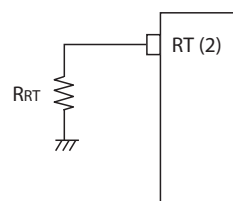Fig.17 Setting procedure for BD9850FVM
       oscillation frequency

Fig.18 RT vs. Oscillation frequency

- Setting of oscillation frequency (BD9851EFV)

  Connecting a resistor to the RT pin (pin 2) and a capacitor to the CT pin allows for the setting of oscillation frequency.
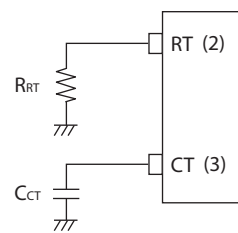

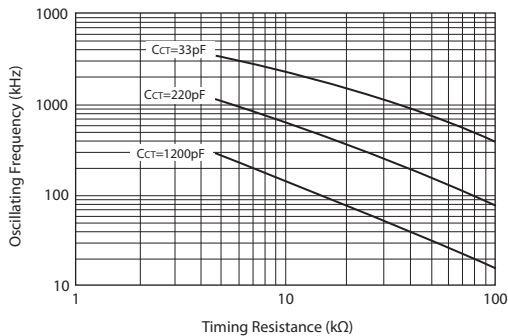Fig. 19 Setting procedure for BD9851EFV oscillation frequency
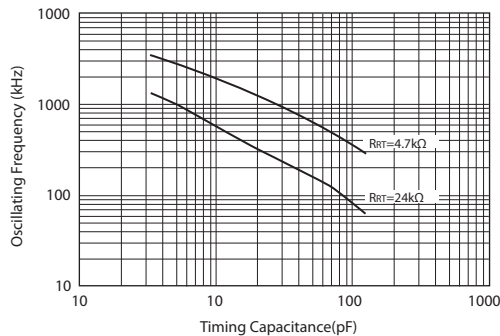

Fig. 20 RT vs. Oscillation frequency

Fig. 20 CT vs. Oscillation frequency

- Setting of timer of short circuit protection circuit (BD9851EFV)

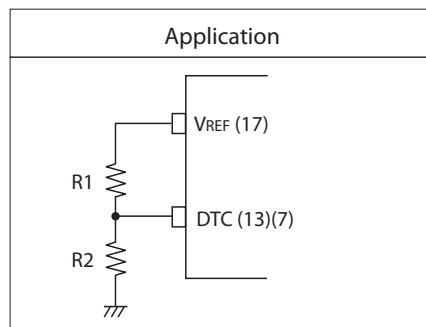| Setting procedure	Application
$T_{SCP} = 7.45 \times 10^5 \times C_{SCP}$ T_{SCP} : Time from output short circuit to latch stop [sec] O_{SCP} : Capacitance of capacitor between the SCP and GND pins [F]	

- Setting of maximum duty (BD9851EFV)

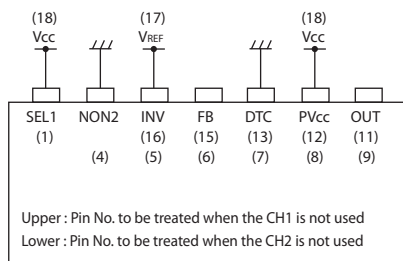| Setting procedure	Application
$DUTY(max.) = 100 \times (V_{DTC} - Vth0) / (Vth100 - Vth0)$ $V_{DTC} = 2.5 \times R2 / (R1 + R2)$ DUTY(max.) : Maximum duty [%] V_{DTC} : DTC pin voltage [V] Vth0 : 0% duty threshold voltage [V] Vth100 : 100% duty threshold voltage [V]	

- Pin treatment of unused channels (BD9851EFV)

Fig. 22 Pin treatment procedure for unused channel on BD9851EFV

In order to use one channel, treat the pins of unused channel as shown above.

● Application circuit / Directions for pattern layout
(BD9850FVM)

C1: In order to reduce ripple noises, set the shortest distance between the Vcc pin and the capacitor pin, and the GND pin and the capacitor pin. Furthermore, the OUT line may pass under the C1.

C2: In order to reduce ripple noises, set the shortest pattern between the VREF pin and the capacitor pin, and the GND pin and the capacitor pin.

R1: In order to stabilize the switching frequency, set the smallest pattern area so that PCB parasitic capacitance for the RT pin will be minimized.
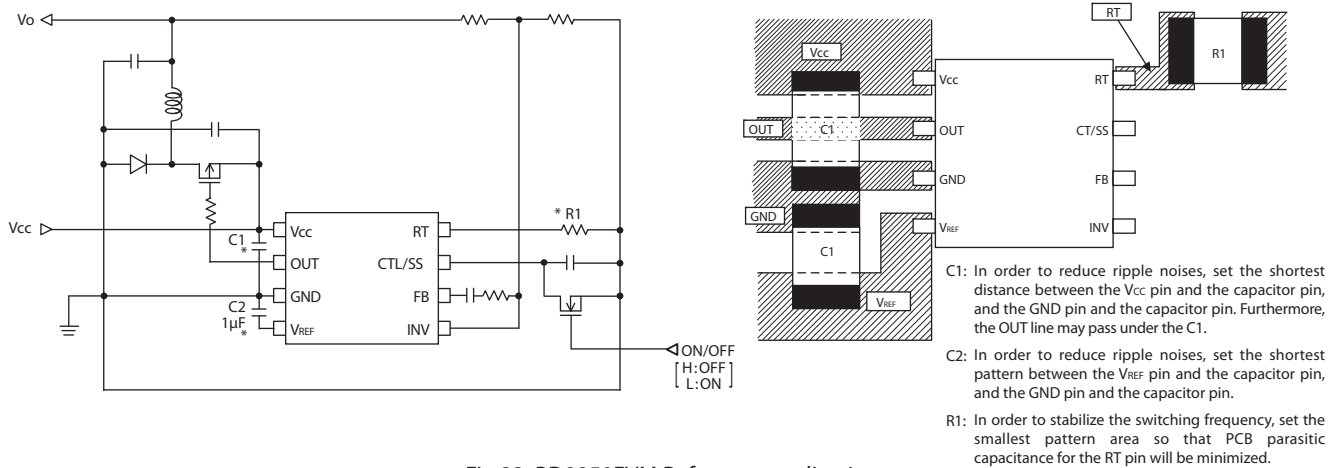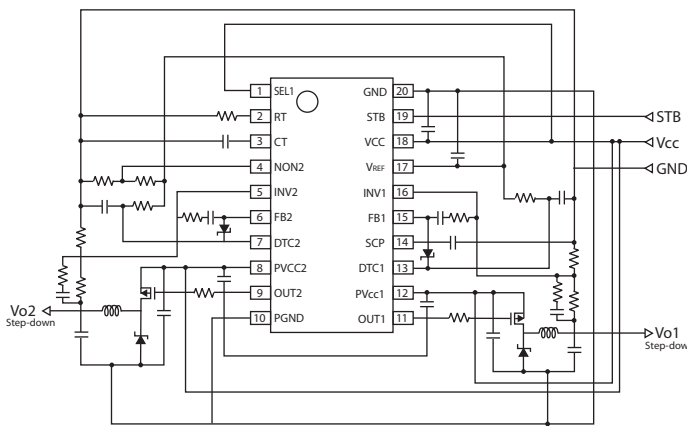
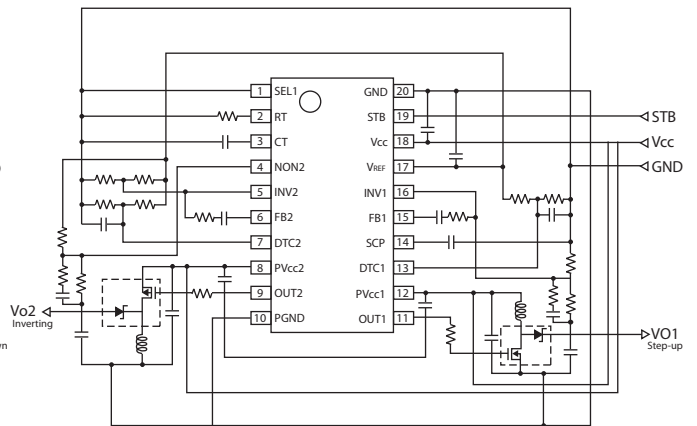Fig.23 BD9850FVM Reference application

Fig.24 Step-down/Step-up application

Fig.25 Step-up/Inverting application

● Equivalent circuit
(BD9850FVM)
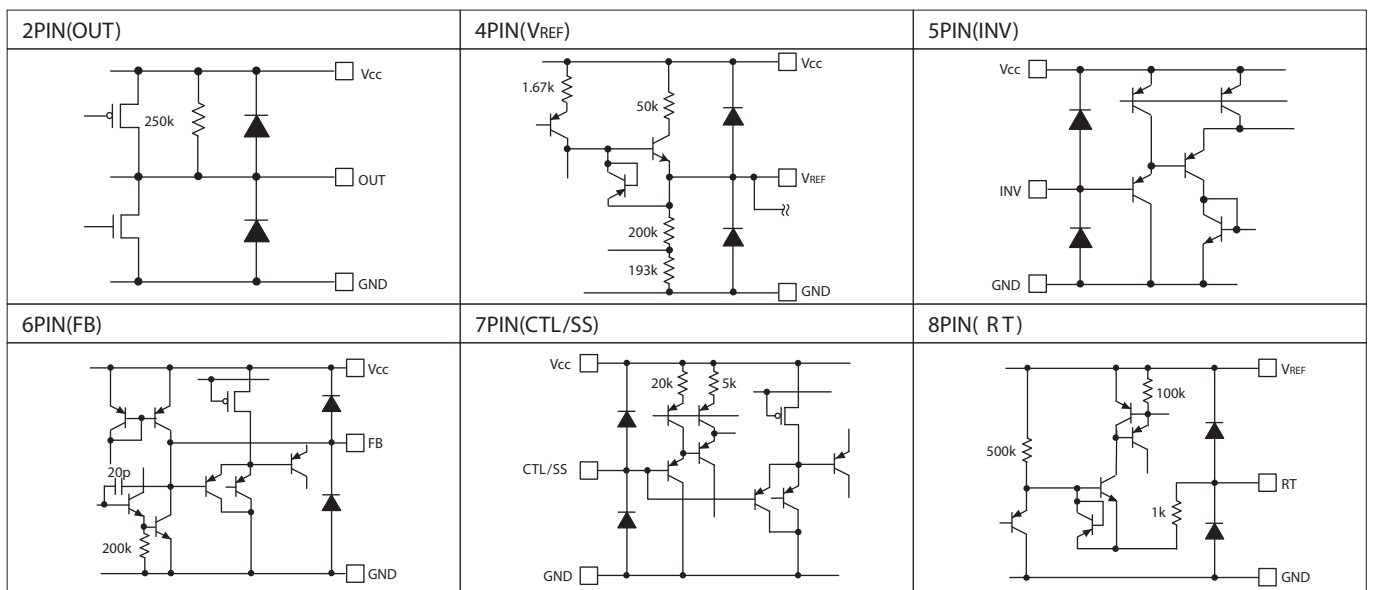

Fig.26 Equivalent circuit (BD9850FVM)

BD9851EFV

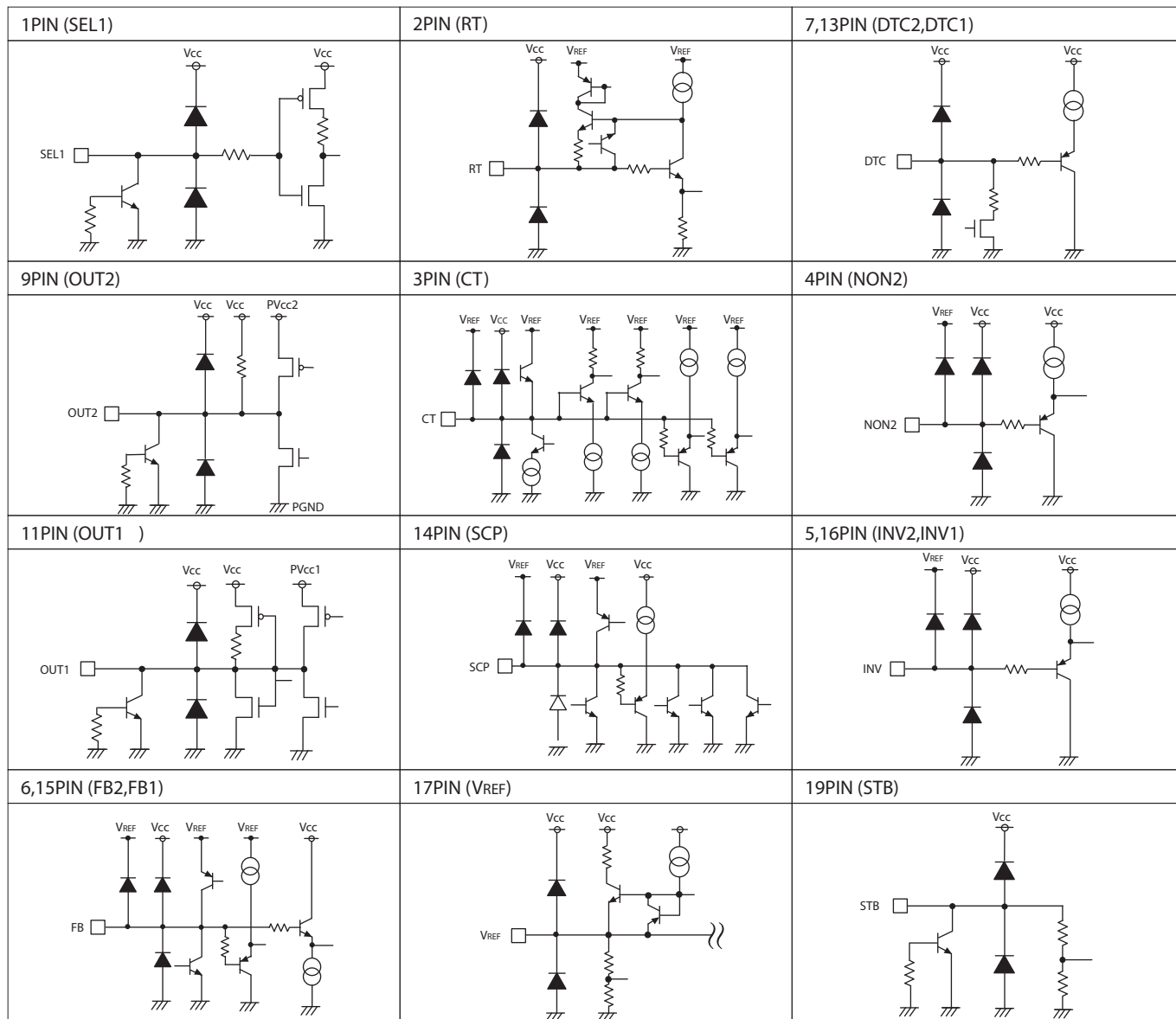| 1PIN (SEL1)	2PIN (RT)	7,13PIN (DTC2,DTC1)
9PIN (OUT2)	3PIN (CT)	4PIN (NON2)
11PIN (OUT1　)	14PIN (SCP)	5,16PIN (INV2,INV1)
6,15PIN (FB2,FB1)	17PIN (VREF)	19PIN (STB)

Fig.27 Equivalent circuit (BD9851EFV)

● Cautions on use

1) Absolute maximum ratings

An excess in the absolute maximum ratings, such as supply voltage, temperature range of operating conditions, etc., can break down the devices, thus making impossible to identify breaking mode, such as a short circuit or an open circuit. If any over rated values will expect to exceed the absolute maximum ratings, consider adding circuit protection devices, such as fuses.

2) GND potential

Ground-GND potential should maintain at the minimum ground voltage level. Furthermore, no terminals should be lower than the GND potential voltage including an electric transients.

3) Thermal design

Use a thermal design that allows for a sufficient margin in light of the power dissipation (Pd) in actual operating conditions.

4) Inter-pin shorts and mounting errors

Use caution when positioning the IC for mounting on printed circuit boards. The IC may be damaged if there is any connection error or if positive and ground power supply terminals are reversed. The IC may also be damaged if pins are shorted together or are shorted to other circuitís power lines.

5) Operation in strong electromagnetic field

Use caution when using the IC in the presence of a strong electromagnetic field as doing so may cause the IC to malfunction.

6) Thermal shutdown circuit (TSD circuit)

The IC incorporates a built-in thermal shutdown circuit (TSD circuit). The thermal shutdown circuit (TSD circuit) is designed only to shut the IC off to prevent runaway thermal operation. It is not designed to protect the IC or guarantee its operation. Do not continue to use the IC after operating this circuit or use the IC in an environment where the operation of this circuit is assumed.

7) Testing on application boards

When testing the IC on an application board, connecting a capacitor to a pin with low impedance subjects the IC to stress. Always discharge capacitors after each process or step. Always turn the IC's power supply off before connecting it to, or removing it from a jig or fixture, during the inspection process. Ground the IC during assembly steps as an antistatic measure. Use similar precaution when transporting and storing the IC.

8) IC pin input

This monolithic IC contains P+ isolation and P substrate layers between adjacent elements to keep them isolated. Pin junctions are formed at the intersection of these P layers with the N layers of other elements, creating a parasitic diode or transistor. For example, the relation between each potential is as follows:

When GND > Pin A and GND > Pin B, the Pin junction operates as a parasitic diode.

When Pin B > GND > Pin A, the PñN junction operates as a parasitic transistor.

Parasitic diodes can occur inevitably in the structure of the IC. The operation of parasitic diodes can result in mutual interference among circuits, operational faults, or physical damage. Accordingly, methods by which parasitic diodes operate, such as applying a voltage that is lower than the GND (P substrate) voltage to an input pin, should not be used.

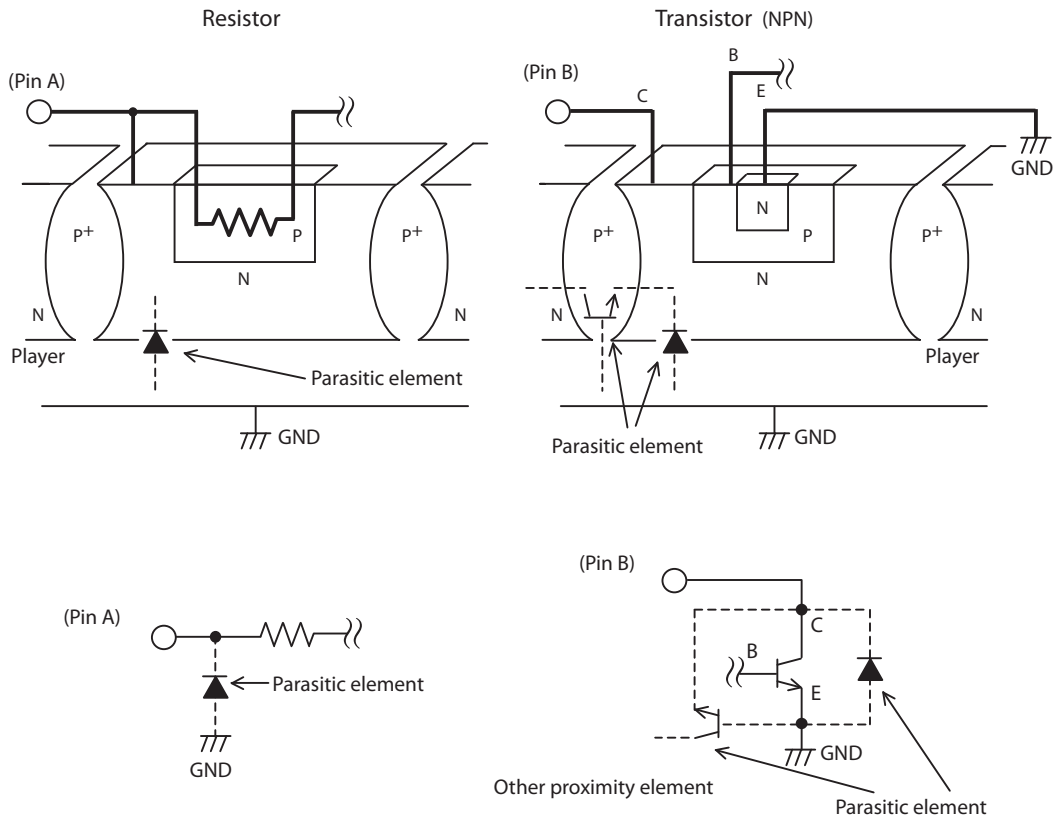Resistor

Transistor (NPN)

Fig. 28 Typical simple construction of monolithic IC

9) Common impedance

The power supply and ground lines must be as short and thick as possible to reduce line impedance. Fluctuating voltage   on the power ground line may damage the device.

10) On the application shown below, Vcc is short-circuited to the Ground with external diode charged, internal circuits may be damaged. recommended to insert a backflow prevention diode in series with the Vcc or a bypass diode between each pin and Vcc.
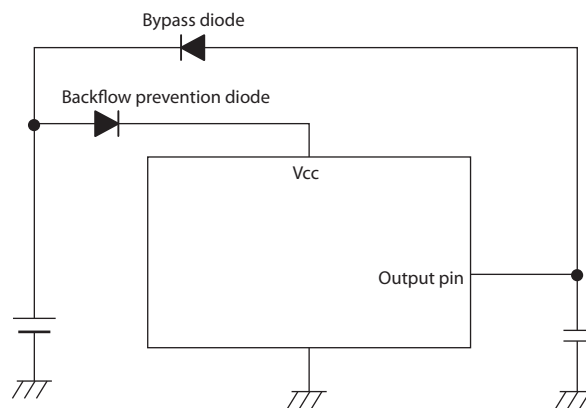
Fig. 29

11) Although ROHM is confident that the example application circuit reflects the best possible recommendations, be sure to verify circuit characteristics for your particular application. Modification of constants for other externally connected circuits may cause variations in both static and transient characteristics for external components as well as this Rohm IC. Allow for sufficient margins when determining circuit constants.

Oscillation frequency setting resistor

12) For the oscillation frequency setting resistor to be inserted between the RT pin and the GND pin, mount this resistor close to the RT pin and provide the shortest pattern routing.
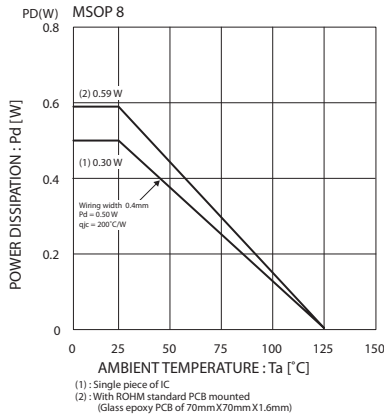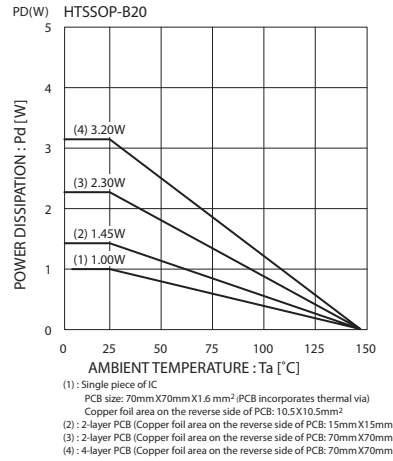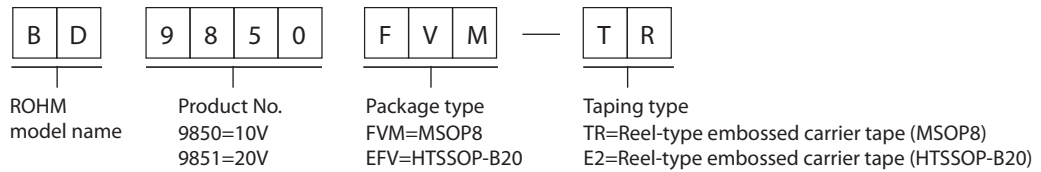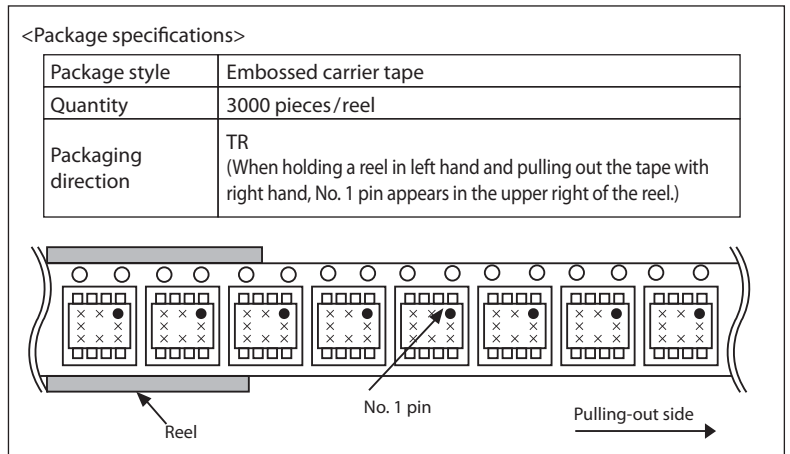
●Thermal derating characteristics

PD(W) MSOP 8

POWER DISSIPATION : Pd [W]

(2) 0.59 W

(1) 0.30 W

Wiring width 0.4mm
Pd = 0.50 W
θjc = 200℃/W

AMBIENT TEMPERATURE : Ta [℃]

(1) : Single piece of IC
(2) : With ROHM standard PCB mounted
     (Glass epoxy PCB of 70mm×70mm×1.6mm)

Fig.30

PD(W) HTSSOP-B20

POWER DISSIPATION : Pd [W]

(4) 3.20W

(3) 2.30W

(2) 1.45W

(1) 1.00W

AMBIENT TEMPERATURE : Ta [℃]

(1) : Single piece of IC
     PCB size: 70mm×70mm×1.6 mm² (PCB incorporates thermal via)
     Copper foil area on the reverse side of PCB: 10.5×10.5mm²
(2) : 2-layer PCB (Copper foil area on the reverse side of PCB: 15mm×15mm
(3) : 2-layer PCB (Copper foil area on the reverse side of PCB: 70mm×70mm
(4) : 4-layer PCB (Copper foil area on the reverse side of PCB: 70mm×70mm

Fig.31

●Selection of order type

| B | D | | 9 | 8 | 5 | 0 | | F | V | M | | — | | T | R |

ROHM
model name

Product No.
9850=10V
9851=20V

Package type
FVM=MSOP8
EFV=HTSSOP-B20

Taping type
TR=Reel-type embossed carrier tape (MSOP8)
E2=Reel-type embossed carrier tape (HTSSOP-B20)

MSOP8

<Dimension>

2.9 ± 0.1
8   5
4.0 ± 0.2
2.8 ± 0.1
1   4
0.475
0.29 ± 0.15
0.6 ± 0.2
0.145 +0.05 −0.03
0.9max.
0.22 +0.05 −0.04
⊕ 0.08 Ⓜ
0.75 ± 0.05
0.08 ± 0.05
0.65
0.08 S

(unit : mm)

<Package specifications>

Package style	Embossed carrier tape
Quantity	3000 pieces/reel
Packaging direction	TR (When holding a reel in left hand and pulling out the tape with right hand, No. 1 pin appears in the upper right of the reel.)

No. 1 pin

Pulling-out side

Reel

HTSSOP-B20

<Dimension>

6.5 ± 0.1
20   11
6.4 ± 0.2
4.4 ± 0.1
1   10
0.325
0.5 ± 0.15
1.0 ± 0.2
0.17 +0.05 −0.03
S
1.0max.
0.85 ± 0.05
0.08 ± 0.05
0.65
0.2 +0.05 −0.04
0.08 S

(unit : mm)

<Package specifications>

Package style	Embossed carrier tape (Moisture-proof specificatin)
Quantity	2500 pieces/reel
Packaging direction	E2 (When holding a reel in left hand and pulling out the tape with right hand, No. 1 pin appears in the upper left of the reel.)

No. 1 pin

Pulling-out side

Reel

Contact us for further information about the products.

San Diego	TEL: +1-858-625-3630	FAX: +1-858-625-3670	Tianjin	TEL: +86-22-23029181	FAX: +86-22-23029183
Atlanta	TEL: +1-770-754-5972	FAX: +1-770-754-0691	Shanghai	TEL: +86-21-6279-2727	FAX: +86-21-6247-2066
Boston	TEL: +1-978-371-0382	FAX: +1-928-438-7164	Hangzhou	TEL: +86-571-87658072	FAX: +86-571-87658071
Chicago	TEL: +1-847-368-1006	FAX: +1-847-368-1008	Nanjing	TEL: +86-25-8689-0015	FAX: +86-25-8689-0393
Dallas	TEL: +1-469-287-5366	FAX: +1-469-362-7973	Ningbo	TEL: +86-574-87654201	FAX: +86-574-87654208
Denver	TEL: +1-303-708-0908	FAX: +1-303-708-0858	Qingdao	TEL: +86-532-5779-312	FAX:+86-532-5779-653
Detroit	TEL: +1-248-348-9920	FAX: +1-248-348-9942	Suzhou	TEL: +86-512-6807-1300	FAX: +86-512-6807-2300
Nashville	TEL: +1-615-620-6700	FAX: +1-615-620-6702	Wuxi	TEL: +86-510-82702693	FAX: +86-510-82702992
Mexico	TEL: +52-33-3123-2001	FAX: +52-33-3123-2002	Shenzhen	TEL: +86-755-8307-3008	FAX: +86-755-8307-3003
Düsseldorf	TEL: +49-2154-9210	FAX: +49-2154-921400	Dongguan	TEL: +86-769-8393-3320	FAX: +86-769-8398-4140
Munich	TEL: +49-8999-216168	FAX: +49-8999-216176	Fuzhou	TEL: +86-591-8801-8698	FAX: +86-591-8801-8690
Stuttgart	TEL: +49-711-7272-370	FAX: +49-711-7272-3720	Guangzhou	TEL: +86-20-3878-8100	FAX: +86-20-3825-5965
France	TEL: +33-1-5697-3060	FAX: +33-1-5697-3080	Huizhou	TEL:+86-752-205-1054	FAX: +86-752-205-1059
United Kingdom	TEL: +44-1-908-306700	FAX: +44-1-908-235788	Xiamen	TEL: +86-592-238-5705	FAX: +86-592-239-8380
Denmark	TEL: +45-3694-4739	FAX: +45-3694-4789	Zhuhai	TEL: +86-756-3232-480	FAX: +86-756-3232-460
Espoo	TEL: +358-9725-54491	FAX: +358-9-7255-4499	Hong Kong	TEL: +852-2-740-6262	FAX: +852-2-375-8971
Salo	TEL: +358-2-7332234	FAX: +358-2-7332237	Taipei	TEL: +886-2-2500-6956	FAX: +886-2-2503-2869
Oulu	TEL: +358-8-5372930	FAX: +358-8-5372931	Kaohsiung	TEL: +886-7-237-0881	FAX: +886-7-238-7332
Barcelona	TEL: +34-9375-24320	FAX: +34-9375-24410	Singapore	TEL: +65-6332-2322	FAX: +65-6332-5662
Hungary	TEL: +36-1-4719338	FAX: +36-1-4719339	Philippines	TEL: +63-2-807-6872	FAX: +63-2-809-1422
Poland	TEL: +48-22-5757213	FAX: +48-22-5757001	Thailand	TEL: +66-2-254-4890	FAX: +66-2-256-6334
Russia	TEL: +7-495-739-41-74	FAX: +7-495-739-41-74	Kuala Lumpur	TEL: +60-3-7958-8355	FAX: +60-3-7958-8377
Seoul	TEL: +82-2-8182-700	FAX: +82-2-8182-715	Penang	TEL: +60-4-2286453	FAX: +60-4-2286452
Masan	TEL: +82-55-240-6234	FAX: +82-55-240-6236	Kyoto	TEL: +81-75-365-1218	FAX: +81-75-365-1228
Dalian	TEL: +86-411-8230-8549	FAX: +86-411-8230-8537	Yokohama	TEL: +81-45-476-2290	FAX: +81-45-476-2295
Beijing	TEL: +86-10-8525-2483	FAX: +86-10-8525-2489			

Catalog No.08T679A '08.9 ROHM ©

Notes

No copying or reproduction of this document, in part or in whole, is permitted without the consent of ROHM CO.,LTD.

The content specified herein is subject to change for improvement without notice.

The content specified herein is for the purpose of introducing ROHM's products (hereinafter "Products"). If you wish to use any such Product, please be sure to refer to the specifications, which can be obtained from ROHM upon request.

Examples of application circuits, circuit constants and any other information contained herein illustrate the standard usage and operations of the Products. The peripheral conditions must be taken into account when designing circuits for mass production.

Great care was taken in ensuring the accuracy of the information specified in this document. However, should you incur any damage arising from any inaccuracy or misprint of such information, ROHM shall bear no responsibility for such damage.

The technical information specified herein is intended only to show the typical functions of and examples of application circuits for the Products. ROHM does not grant you, explicitly or implicitly, any license to use or exercise intellectual property or other rights held by ROHM and other parties. ROHM shall bear no responsibility whatsoever for any dispute arising from the use of such technical information.

The Products specified in this document are intended to be used with general-use electronic equipment or devices (such as audio visual equipment, office-automation equipment, communication devices, electronic appliances and amusement devices).

The Products are not designed to be radiation tolerant.

While ROHM always makes efforts to enhance the quality and reliability of its Products, a Product may fail or malfunction for a variety of reasons.

Please be sure to implement in your equipment using the Products safety measures to guard against the possibility of physical injury, fire or any other damage caused in the event of the failure of any Product, such as derating, redundancy, fire control and fail-safe designs. ROHM shall bear no responsibility whatsoever for your use of any Product outside of the prescribed scope or not in accordance with the instruction manual.

The Products are not designed or manufactured to be used with any equipment, device or system which requires an extremely high level of reliability the failure or malfunction of which may result in a direct threat to human life or create a risk of human injury (such as a medical instrument, transportation equipment, aerospace machinery, nuclear-reactor controller, fuel-controller or other safety device). ROHM shall bear no responsibility in any way for use of any of the Products for the above special purposes. If a Product is intended to be used for any such special purpose, please contact a ROHM sales representative before purchasing.

If you intend to export or ship overseas any Product or technology specified herein that may be controlled under the Foreign Exchange and the Foreign Trade Law, you will be required to obtain a license or permit under the Law.

Thank you for your accessing to ROHM product informations.
More detail product informations and catalogs are available, please contact your nearest sales office.

ROHM Customer Support System

THE AMERICAS / EUROPE / ASIA / JAPAN

www.rohm.com

Contact us : webmaster @ rohm.co.jp

ROHM
SEMICONDUCTOR