System Motor Driver for CD/DVD/BD Players

6ch System Motor Driver for Car AV

BD8253EFV-M

General Description

BD8253EFV-M is a 6-ch motor driver system developed for driving coil actuator (2ch), SLED motor (2ch), loading motor and three phase motor for spindle.
It can drive motor and coil of the DVD drive.

Key Specifications

- Ron(Spindle): 1.0Ω(Typ)
- Ron(SLED): 2.2Ω(Typ)
- Ron(Actuator): 2.2Ω(Typ)
- Ron(Loading): 2.2Ω(Typ)
- Driver Temperature Range -40°C to +85°C

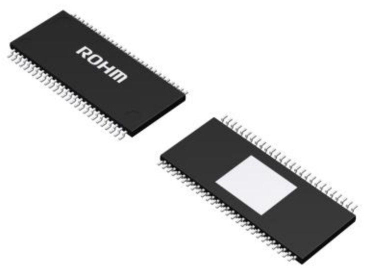
Features

- AEC-Q100 Qualified(Note 1)
- Two Control Pins For Each Driver ON/OFF, Standby Mode And Brake Mode For Spindle
- High Efficiency At 180° PWM For Spindle Driver
- Built In Current Limit, Hall Bias, FG and Reverse Protect Circuit For Spindle
- Built-in 2-channel Stepping Motor Driver For SLED
- Built-in VCC Short And GND Short Circuit Protection For Loading Driver
- Built-in Over Current Protection Circuit For Actuator Driver

(Note 1) Grade3

Package

Package	W(Typ) x D(Typ) x H(Max)
HTSSOP-B54	18.50mm x 9.50mm x 1.00mm



HTSSOP-B54

Applications

- Car Navigation
- Car AV

Typical Application Circuit

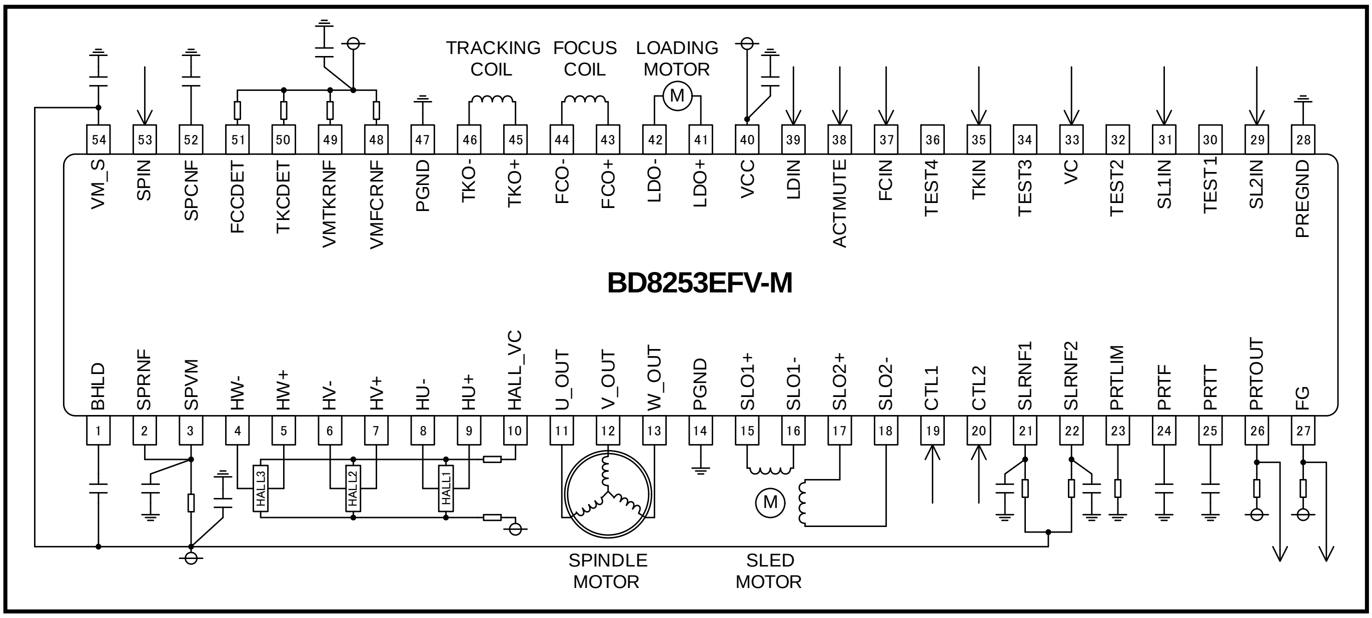


Figure 1. Application Circuit

〇Product structure : Silicon monolithic integrated circuit 〇This product has no designed protection against radioactive rays

Contents

Pin Configuration (TOP VIEW)

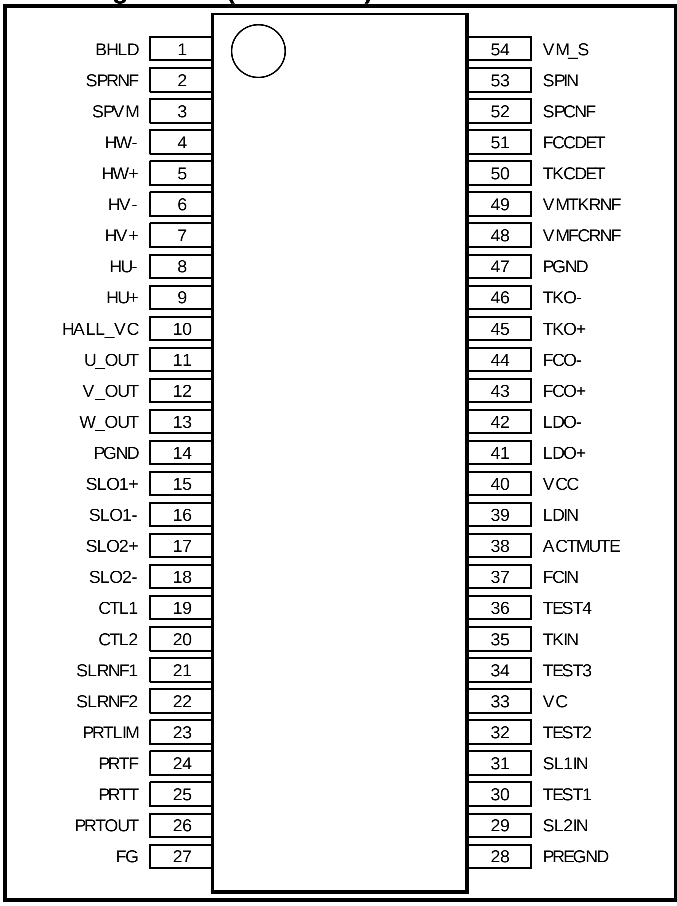


Figure 2. Pin Configuration

Block Diagram

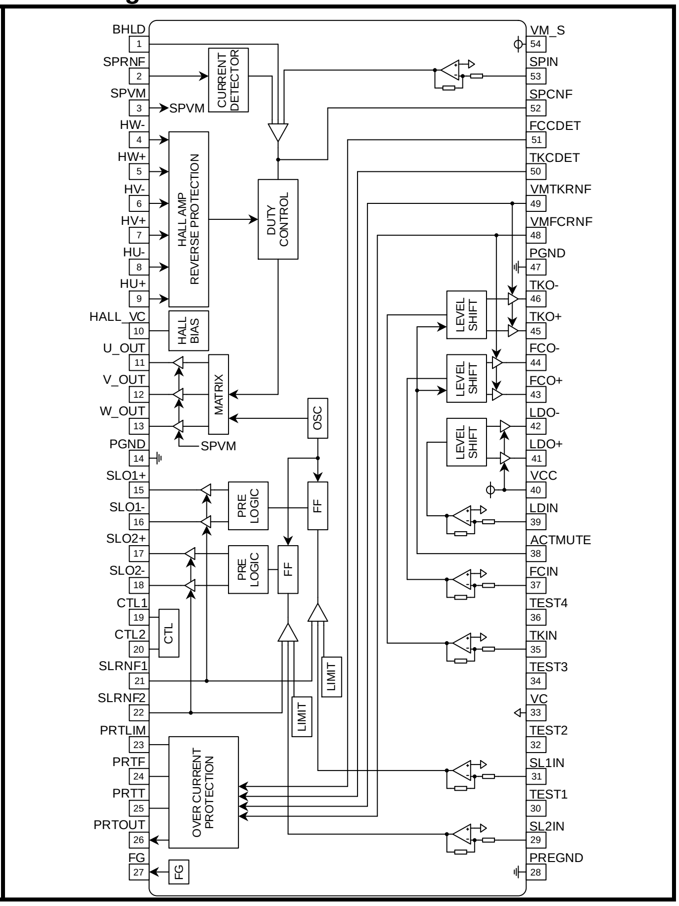


Figure 3. Block Diagram

Pin Description

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	BHLD	Spindle current sense bottom hold	28	PREGND	Pre block ground
2	SPRNF	Spindle driver current sense input	29	SL2IN	SLED driver 2 control input
3	SPVM	Spindle driver power supply	30	TEST1	Test terminal(Leave Open)
4	HW-	Hall amplifier W negative input	31	SL1IN	SLED driver 1 control input
5	HW+	Hall amplifier W positive input	32	TEST2	Test terminal(Leave Open)
6	HV-	Hall amplifier V negative input	33	VC	Reference voltage input
7	HV+	Hall amplifier V positive input	34	TEST3	Test terminal(Leave Open)
8	HU-	Hall amplifier U negative input	35	TKIN	Tracking control input
9	HU+	Hall amplifier U positive input	36	TEST4	Test terminal(Leave Open)
10	HALL_VC	Hall Bias	37	FCIN	Focus control input
11	U_OUT	Spindle driver U output	38	ACTMUTE	Mute terminal for Focus/Tracking
12	V_OUT	Spindle driver V output	39	LDIN	Loading driver input
13	W_OUT	Spindle driver W output	40	VCC	Power supply for pre driver and loading
14	PGND	Spindle and SLED power ground	41	LDO+	Loading driver positive output
15	SLO1+	SLED driver 1 positive output	42	LDO-	Loading driver negative output
16	SLO1-	SLED driver 1 negative output	43	FCO+	Focus driver positive output
17	SLO2+	SLED driver 2 positive output	44	FCO-	Focus driver negative output
18	SLO2-	SLED driver 2 negative output	45	TKO-	Tracking driver positive output
19	CTL1	Driver logic control input 1	46	TKO+	Tracking driver negative output
20	CTL2	Driver logic control input 2	47	PGND	Actuator and Loading power ground
21	SLRNF1	SLED 1 power supply and current sense	48	VMFCRNF	Focus power supply and current sense
22	SLRNF2	SLED 2 power supply and current sense	49	VMTKRNF	Tracking power supply and current sense
23	PRTLIM	Actuator Over current Protect Limit setting	50	TKCDET	Current detect for tracking driver
24	PRTF	Protect Time setting for focus	51	FCCDET	Current detect for focus driver
25	PRTT	Protect Time setting for tracking	52	SPCNF	Spindle driver loop filter
26	PRTOUT	Protect output	53	SPIN	Spindle driver input
27	FG	FG output	54	VM_S	Spindle/SLED control block power supply

Absolute Maximum Ratings (Ta=25°C)

Parameter	Symbol	Rating	Unit
Pre / Loading Driver Power Supply Voltage	V_{VCC}, V_{VM_S}	12	V
Spindle and SLED Driver Output Power Supply Voltage	V_{SPVM}, V_{SPRNF}, V_{SLRNF1}, V_{SLRNF2}	V_{VM_S}	V
Actuator Output Power Supply Voltage	$V_{VMTKRNF}$, $V_{VMFCRNF}$	V_{VCC}	V
Input Terminal Voltage 1	V_{IN1} (Note1)	V_{VCC}	V
Input Terminal Voltage 2	V_{IN2} (Note2)	V_{VM_S}	V
Output Terminal Voltage	V_{OUT} (Note3)	12	V
Operating Temperature Range	Topr	-40 to +85	°C
Junction Temperature Range	Tj	-40 to +150	°C
Storage Temperature Range	Tstg	-55 to +150	°C

(Note 1) CTL1, CTL2, VC, LDIN, ACTMUTE, TKIN, FCIN
(Note 2) HU+, HU-, HV+, HV-, HW+, HW-,SL1IN, SL2IN, SPIN, FKCDET, TCCDET
(Note 3) FG, U_OUT, V_OUT, W_OUT, SLO1+, SLO1-, SLO2+, SLO2-, PRTOUT, LDO+, LDO-, FCO+, FCO-, TKO+, TKO-

Caution: Operating the IC over the absolute maximum ratings may damage the IC. The damage can either be a short circuit between pins or an open circuit between pins and the internal circuitry. Therefore, it is important to consider circuit protection measures, such as adding a fuse, in case the IC is operated over the absolute maximum ratings.

Recommended Operating Conditions (Ta=-40°C to +85°C)

Parameter	Symbol	Min	Typ	Max	Unit
Pre / Loading Driver Power Supply Voltage (Note1)	V_{VCC}	6	8	10	V
Spindle/SLED control block power supply (Note1)	V_{VM_S}	6	8	V_{VCC}	V
Spindle Driver Power Supply Voltage (Note1) (Note2)	V_{SPVM}, V_{SPRNF}	-	V_{VM_S}	-	V
SLED Driver Power Supply Voltage (Note1) (Note2)	V_{SLRNF1}, V_{SLRNF2}	-	V_{VM_S}	-	V
Actuator Driver Power Supply Voltage (Note1) (Note2)	$V_{VMFCRNF}$, $V_{VMTKRNF}$	4	8	V_{VCC}	V

(Note 1) Consider power dissipation when deciding power supply voltage.
(Note 2) Detection resistance is needed between SPVM, SPRNF, SLRNF1, SLRNF2 and VM_S, and between VMFCRNF, VMTKRNF and AVM.

Thermal Resistance

Parameter	Symbol	Thermal Resistance (Note 1)		Unit
		1s (Note 3)	2s2p (Note 4)	
Junction to Ambient	θ_{JA}	66.8	20.1	°C/W
Junction to Top Characterization Parameter (Note 2)	Ψ_{JT}	2	2	°C/W

(Note 1) Based on JESD51-2A(Still-Air)
(Note 2) The thermal characterization parameter to report the difference between junction temperature and the temperature at the top center of the outside surface of the component package.

(Note 3) Using a PCB board based on JESD51-3.

Layer Number of Measurement Board	Material	Board Size
Single	FR-4	114.3mm x 76.2mm x 1.57mmt

Top	
Copper Pattern	Thickness
Footprints and Traces	70µm

(Note 4) Using a PCB board based on JESD51-5, 7.

Layer Number of Measurement Board	Material	Board Size	Thermal Via (Note 5)	
			Pitch	Diameter
4 Layers	FR-4	114.3mm x 76.2mm x 1.6mmt	1.20mm	Φ0.30mm

Top		2 Internal Layers		Bottom	
Copper Pattern	Thickness	Copper Pattern	Thickness	Copper Pattern	Thickness
Footprints and Traces	70µm	74.2mm x 74.2mm	35µm	74.2mm x 74.2mm	70µm

(Note 5) This thermal via connects with the copper pattern of all layers..

Electrical Characteristics

(Unless otherwise specified, Ta=25°C, $V_{VCC}=V_{SPVM}=V_{SLRNF1}=V_{SLRNF2}=V_{VM\_S}$=8V, $V_{VMFCRNF}=V_{VMTKRNF}$=8V, V_{VC}=1.25V, R_{L}=8Ω, R_{LSP}=2Ω, R_{SPRNF}=0.165Ω, $R_{SLRNF1}=R_{SLRNF2}$=0.5Ω)

Parameter			Symbol	Limits			Unit	Conditions
				Min	Typ	Max		
Circuit Current		Quiescent Current	I_{Q}	-	12.5	25	mA	At no-load, V_{CTL2}=H
		Standby Current	I_{ST}	-	0.22	1.0	mA	$V_{CTL1}=V_{CTL2}$=L
Spindle Motor Driver	Hall Bias	Hall Bias Voltage	V_{HB}	0.45	0.9	1.35	V	I_{HB}=10mA
	Hall Amplifier	Input Bias Current	I_{HIB}	-5	-	5	µA	
		Input Level	V_{HIM}	50	-	-	mVpp	
		Common Mode Input Range	V_{HICM}	1	-	6	V	
	Spindle Torque Input and Output	Input Dead Zone (One Side)	V_{DZSP}	0	10	40	mV	
		Input-Output Gain	gm_{SP}	1.59	2.05	2.46	A/V	R_{SPRNF}=0.165Ω, R_{LSP}=2Ω
		Output ON Resistance (Total Sum)	R_{ONSP}	-	1	1.8	Ω	I_{L}=500mA
		Output Limit Current	I_{LIMSP}	1.2 (0.198)	1.5 (0.247)	1.8 (0.297)	A (V)	R_{SPRNF}=0.165Ω
		Input Impedance	R_{INSP}	35	47	59	kΩ	
		PWM Frequency	f_{OSC}	-	100	-	kHz	
	FG Output	Low Level Voltage	V_{FGL}	-	0.1	0.3	V	10KΩ pull-up (3.3V)
SLED Motor Driver		Input Dead Zone (One Side)	V_{DZSL}	5	30	55	mV	
		Input Impedance	R_{INSL}	35	47	59	kΩ	
		Input-Output Gain	gm_{SL}	0.51	0.66	0.81	A/V	R_{SLRNF1}, R_{SLRNF2}=0.5Ω
		Output ON Resistance (Total Sum)	R_{ONSL}	-	2.2	3.7	Ω	I_{L}=500mA
		Output Limit Current	I_{LIMSL}	0.42 (0.21)	0.5 (0.25)	0.58 (0.29)	A (V)	R_{SLRNF1}, R_{SLRNF2}=0.5Ω
		PWM Frequency	f_{OSC}	-	100	-	kHz	
Actuator Driver		Output Offset Voltage	V_{OFACT}	-50	0	50	mV	R_{L}=8Ω
		Output ON Resistance (Total Sum)	R_{ONACT}	-	2.2	3.7	Ω	I_{L}=500mA
		Input Impedance	R_{INACT}	37	50	63	kΩ	
		Input-Output Gain	G_{VACT}	16	17.5	19	dB	R_{L}=8Ω
Loading Driver		Output Offset Voltage	V_{OFLD}	-75	0	75	mV	R_{L}=8Ω
		Output ON Resistance (Total Sum)	R_{ONLD}	-	2.2	3.7	Ω	I_{L}=500mA
		Input Impedance	R_{INLD}	35	47	59	kΩ	
		Input-Output Gain	G_{VLD}	14.2	15.6	16.9	dB	R_{L} =8Ω
Actuator Protection Circuit		PRTT/PRTF Default Voltage	V_{PRTREF}	1.00	1.06	1.12	V	
		PRTT/PRTF Protect Detection Voltage	V_{PRTDET}	2.82	3.00	3.18	V	
		PRTLIM Voltage	V_{PRTLIM}	500	530	560	mV	
		Detection Amplifier Input Offset Voltage	V_{OFDET}	-5	0	5	mV	
Actuator Protection Flag Output		PRTOUT Low Level Output Voltage	V_{OL1}	-	0.1	0.3	V	33kΩ pull-up (3.3V)
ACTMUTE CTL1, CTL2		L Input Voltage	V_{ICTL}	-	-	0.8	V	
		H Input Voltage	V_{ICTH}	2	-	-	V	
		High Level Input Current	I_{CTH}	-	50	100	µA	V_{CTL1}, V_{CTL2}, $V_{ACTMUTE}$ = 3.3V
Function		VC Drop Mute Voltage	V_{MVC}	0.4	0.7	1	V	
		VCC Drop Mute Voltage	V_{MVCC}	3.4	3.8	4.2	V	
		VC Input Current	I_{VC}	-	4	8	µA	V_{VC}=1.25V

Typical Performance Curves

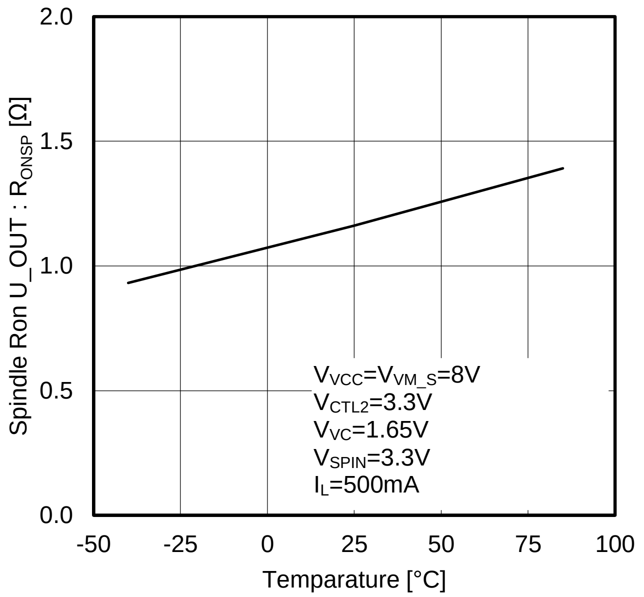


Figure 4. Spindle Motor Driver
U_OUT Output ON Resistance (total sum) : R_{ONSP}

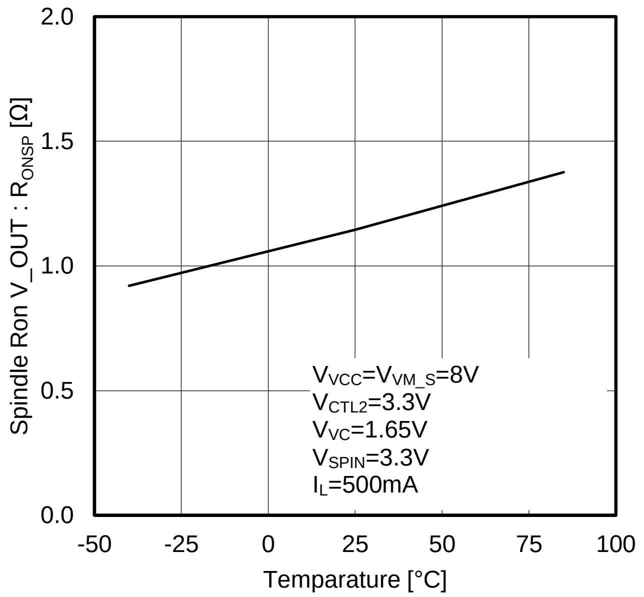


Figure 5. Spindle Motor Driver
V_OUT Output ON Resistance (Total Sum) : R_{ONSP}

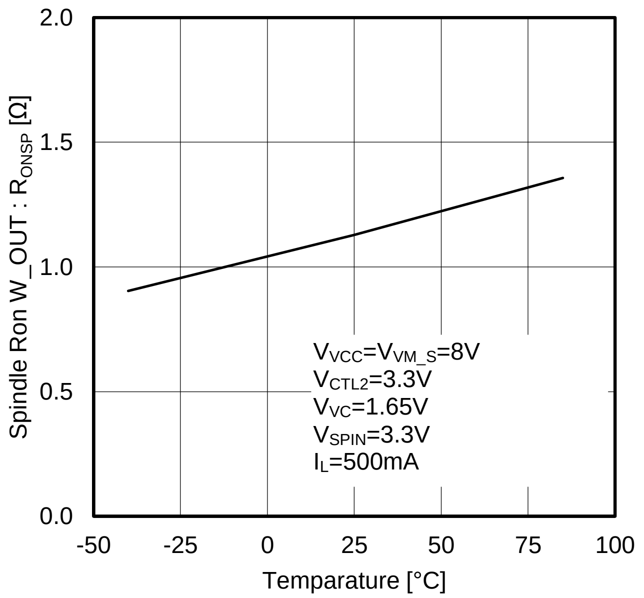


Figure 6. Spindle Motor Driver
W_OUT Output ON Resistance (Total Sum) : R_{ONSP}

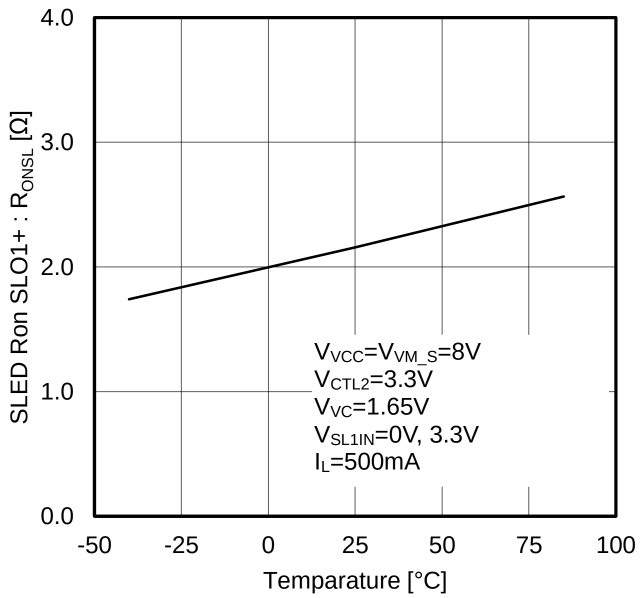


Figure 7. SLED Motor Driver
SLO1+ Output ON Resistance (Total Sum) : R_{ONSL}

Typical Performance Curves - continued

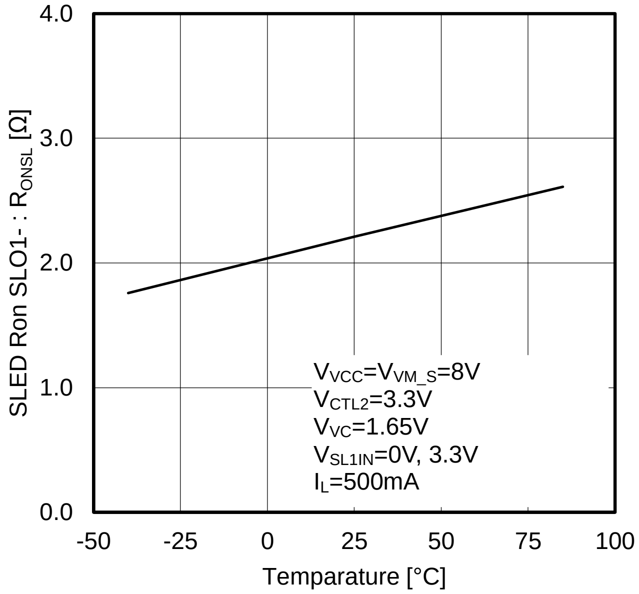


Figure 8. SLED Motor Driver
SLO1- Output ON Resistance (Total Sum) : R_{ONSL}

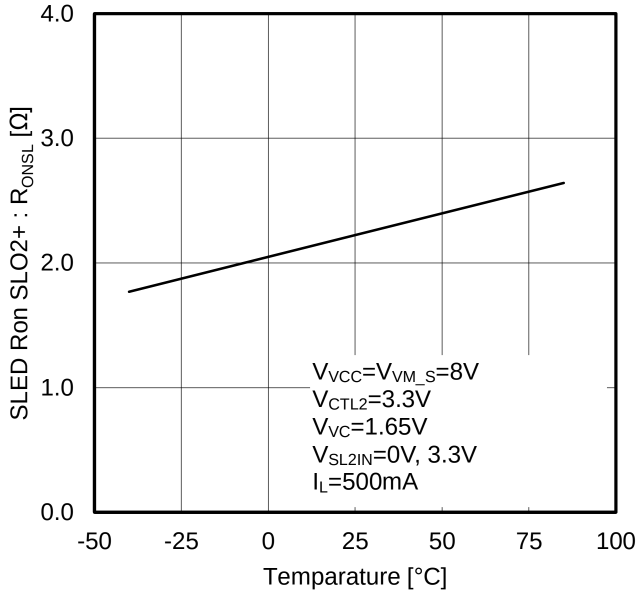


Figure 9. SLED Motor Driver
SLO2+ Output ON Resistance (Total Sum) : R_{ONSL}

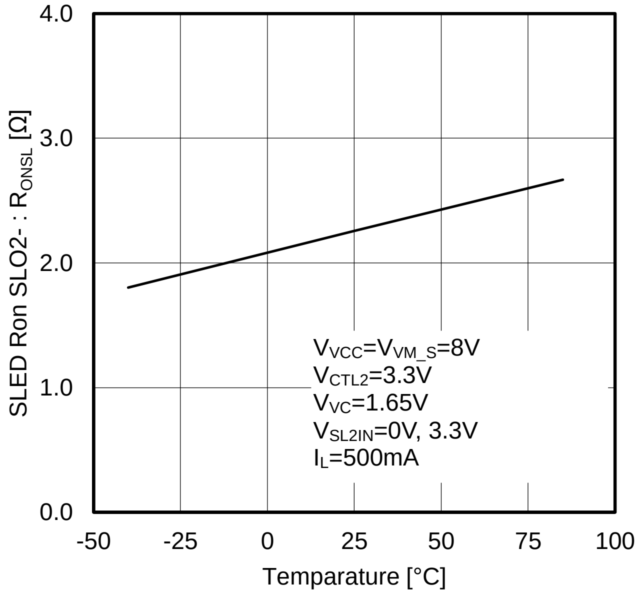


Figure 10. SLED Motor Driver
SLO2- Output ON Resistance (Total Sum) : R_{ONSL}

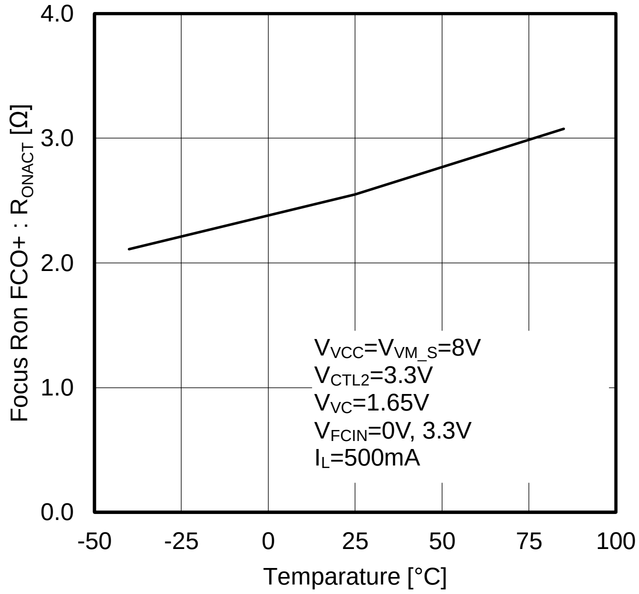


Figure 11. Actuator Driver
FCO+ Output ON Resistance (Total Sum) : R_{ONACT}

Typical Performance Curves - continued

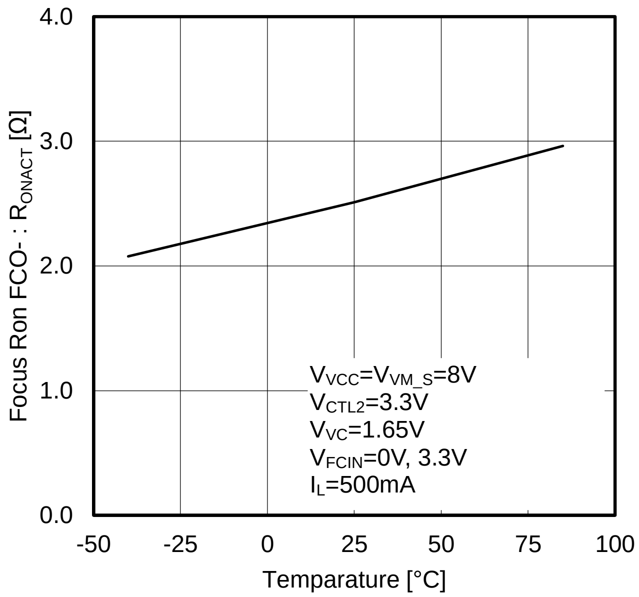


Figure 12. Actuator Driver
FCO- Output ON Resistance (Total Sum) : R_{ONACT}

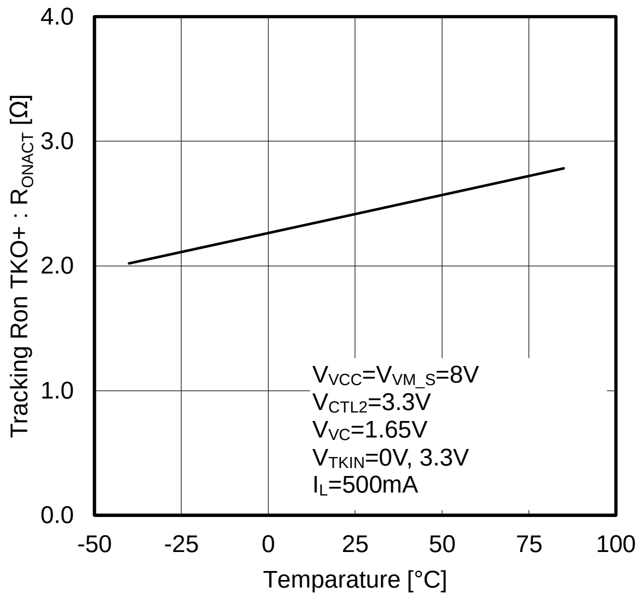


Figure 13. Actuator Driver
TKO+ Output ON Resistance (Total Sum) : R_{ONACT}

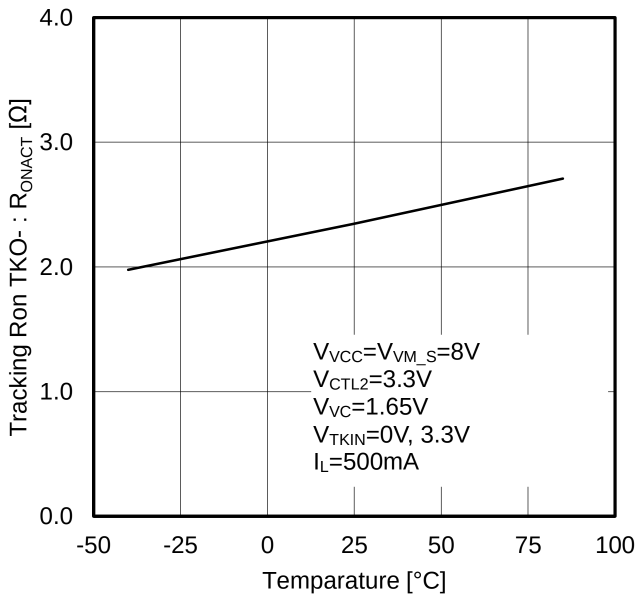


Figure 14. Actuator Driver
TKO- Output ON Resistance (Total Sum) : R_{ONACT}

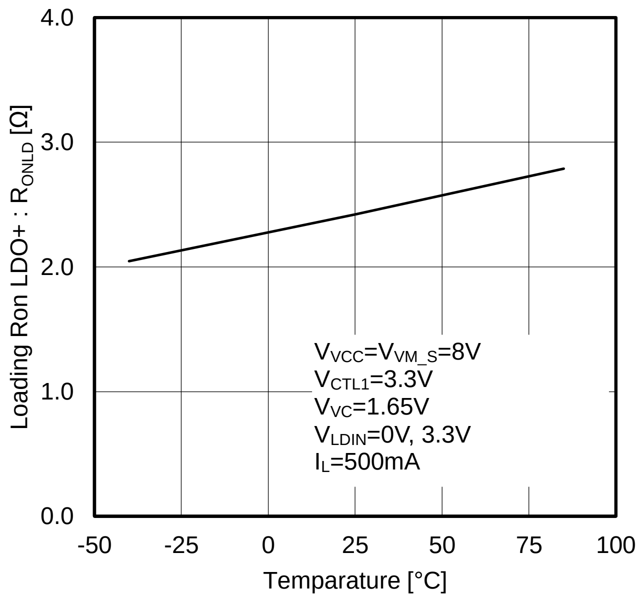


Figure 15. Loading Driver
LDO+ Output ON Resistance (Total Sum) : R_{ONLD}

Typical Performance Curves - continued

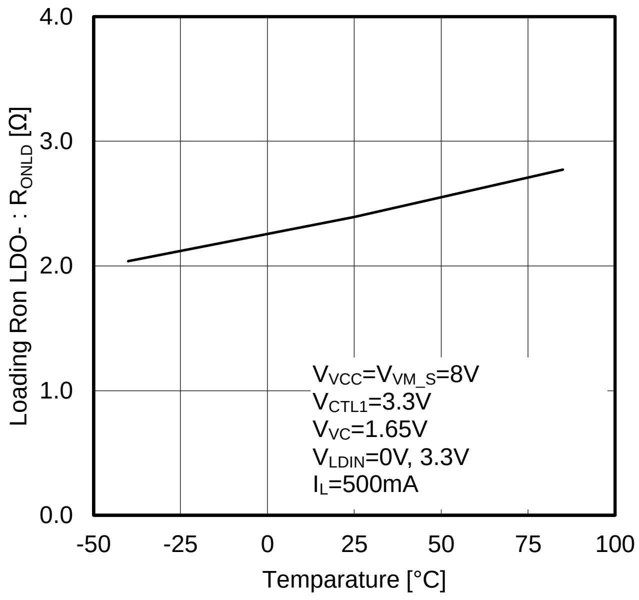


Figure 16. Loading Driver
LDO- Output ON Resistance (Total Sum) : R_{ONLD}

Application Information

1. Driver Logic control terminal (CTL1, CTL2 & ACTMUTE) (Pin 19, 20, 38)
   All driver's and spindle driver's brake mode can be switched ON/OFF by inputting H level (2V or more) or L levels (0.8V or less) to these terminals. ACTMUTE can be used individually to Turn ON/OFF Actuator.
   ACTMUTE Pin and VCC Pin can be short-circuited if the control logic with the control pin (CTL2) is ok.

▼ Driver Logic (Normal Operation)

CTL1 (Pin 19)	CTL2 (Pin 20)	ACTMUTE (Pin 38)	SPINDLE Output	SLED Output	ACTUATOR Output	LOADING Output
L	L	-	Hi-Z	Hi-Z	Hi-Z	Hi-Z
H	L	-	Hi-Z	ACTIVE	MUTE(Note 1)	ACTIVE
-	H	H	ACTIVE(Note 2)	ACTIVE	ACTIVE	MUTE(Note 1)
-	H	L	ACTIVE(Note 2)	ACTIVE	MUTE(Note 1)	MUTE(Note 1)

(Note 1) Positive and Negative output of the driver output pull-up to Power/2 (=VREF)
(Note 2) Active state of spindle output is described in the following table (1-1).

▼Spindle Driver Logic table

CTL1 (Pin 19)	CTL2 (Pin 20)	ACTMUTE (Pin 38)	SPIN > VC	SPIN < VC
L	H	-	Forward Mode	Reverse Braking Mode
H	H	-	Forward Mode	Short Braking Mode

▼ Driver Logic (UVLO, VC Protection Operation, TSD)

CTL1 (Pin 19)	CTL2 (Pin 20)	ACTMUTE (Pin 38)	SPINDLE Output	SLED Output	ACTUATOR Output	LOADING Output
L	L	-	Hi-Z	Hi-Z	Hi-Z	Hi-Z
Other Condition			Hi-Z	Hi-Z	Mute(note 1)	Mute(note 1)

(Note 1) Positive and Negative output of the driver output pull-up to Power/2 (=VREF)

2. VCC Drop Mute (UVLO)
   If VCC pin voltage becomes 3.8V (typ) or less, output of all channels turns OFF.
   If VCC pin voltage becomes 4.0V (typ) or high, output of all channels turns ON again.
   Please refer to the above table for the details of Output status.

3. VC Drop Mute (VC DROP MUTE)
   If VC pin voltage becomes 0.7V (typ) or less, output of all channels turns OFF.
   Please set this value to a minimum of 1.2V for normal use.
   Please refer to the above table for the details of Output status

4. Thermal Shutdown Circuit (TSD)
   In order to prevent the IC from thermal destruction, IC has built in thermal shutdown circuit.
   Thermal shutdown circuit is designed to turn OFF all output channels when the junction temperature (Tj) reaches 175°C (Typ). IC operation begins again when the junction temperature decreases to 150°C (Typ) or less. Please refer the table (2) above for detail of the output state. However, in this state also where the thermal shutdown is operating, and if heat is applied from the outside continuously, thermal run-away may be carried out and it may result in destruction of IC.

5. Polarity of Output Pin
   Positive and negative output of Actuator, Loading and SLED driver means the polarity of each inputs (FCIN, TKIN,LDIN, SL1IN, SL2IN)
   For example, FCO+>FCO- at FCIN>VC and FCO+<FCO- at FCIN<VC.

6. Actuator Driver (Focus/Tracking)
(1) Voltage Gain Calculation
The output voltage is set by the input voltage (difference voltage of FCIN/TKIN and VC) x voltage gain (GVACT).
Voltage gain can be adjusted by an external input resistor RIN.

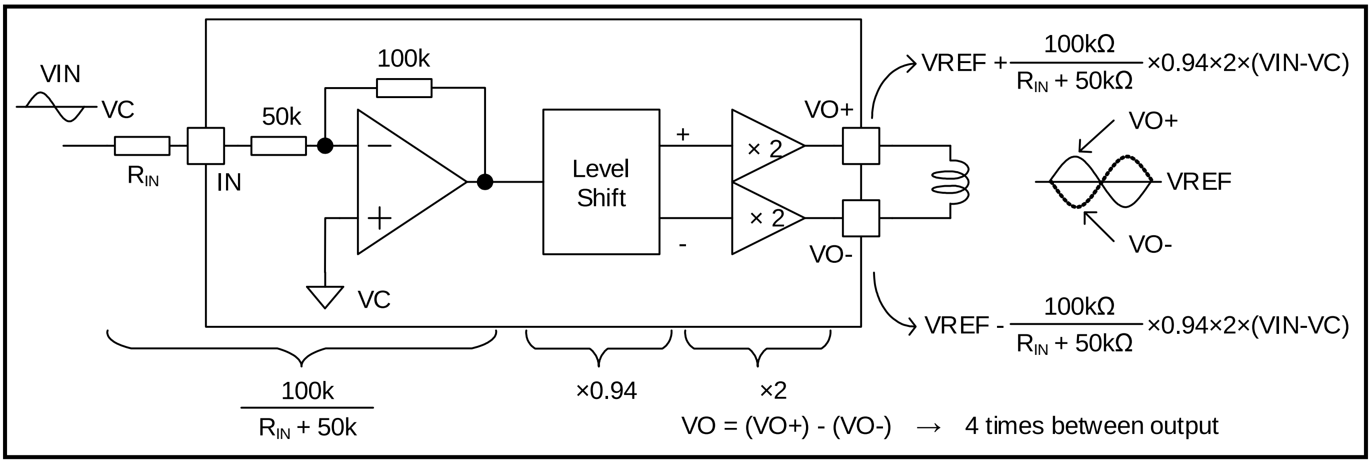


Figure 17. Actuator (Focus/Tracking) Closed Loop Voltage Gain Calculation Diagram

Voltage Gain expression is given by following formula

$$G_{VACT} = \frac{VO}{VIN} = \frac{100\text{k}}{R_{IN}+50\text{k}} \times 0.94 \times 2 \times 2 \ \text{[dB]}$$

When RIN = 0

$$G_{VACT} = \frac{VO}{VIN} = \frac{100\text{k}}{50\text{k}} \times 0.94 \times 2 \times 2 = 17.5 \ \text{[dB]}$$

(2) Actuator Over Current Protection Function (OCP)

This is the protect function for the actuator if it detects an over current state in a certain amount of time.

PRTT, PRTF (Timer)	PRTOUT (Flag)	Actuator Output
> 3.0V	L to H	Active
< 1.1V	H to L	Active

The current threshold set by the external load is assumed to be 0, where in the capacitor current is charged and discharged proportional to the load current value.
The time for the protection to activate (PRTOUT=H) is determined by the resistor values connected to the terminals: VMTKRNF, VMFCRNF, TKCDET, FCCDET, PRTLIM and the capacitors connected to the terminals: PRTT, PRTF. The default voltage value of the PRTT and PRTF terminals is 1.06V (Typ). Capacitor is charged by the over current and protection activates (PRTOUT=H) when PRTT and PRTF are about 3.0V (Typ). If PRTT and PRTF is below 1.1V, the protection will be released (PRTOUT=L). Regardless of PRTOUT, if ACTMUTE input terminal is set low the actuator can be muted.

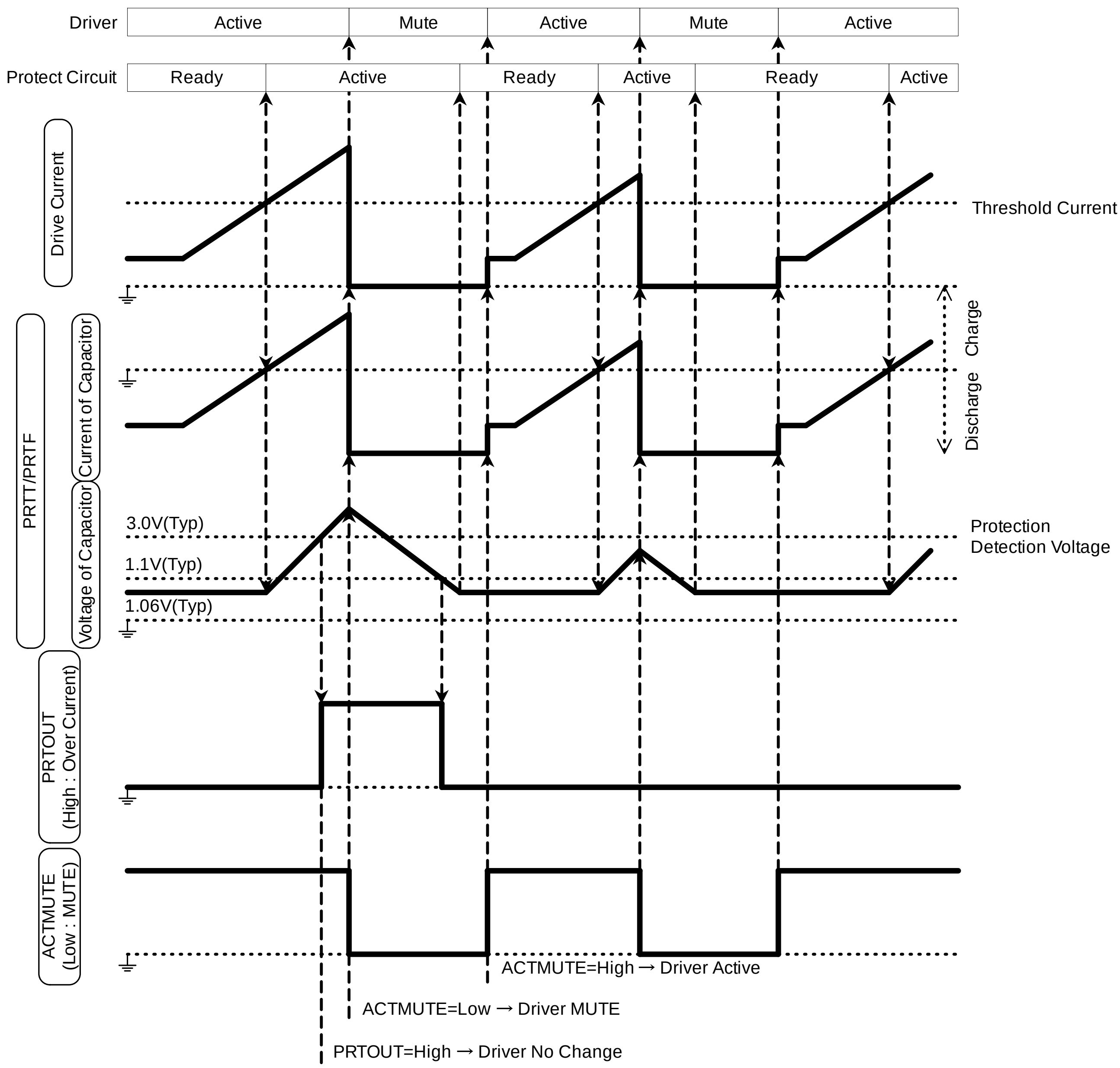


Figure 18. ACT_OCP Timing Chart

(3) Configuration of Actuator Over Current Protection Circuit

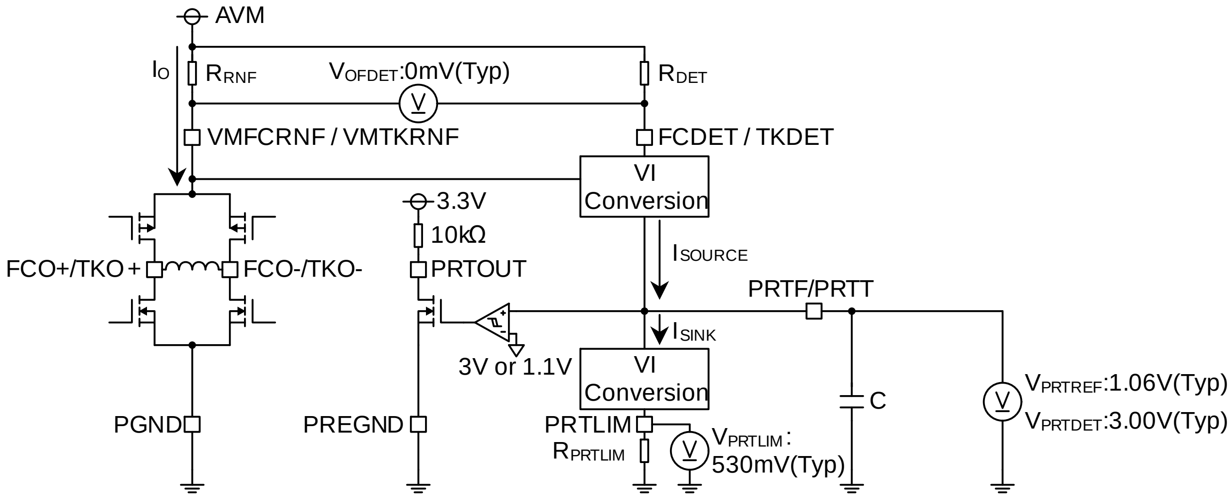


Figure 19. Over Current Protection Circuit

The capacitor's charge and discharge current I_{SINK} and I_{SOURCE}, can be computed using the following:

$$I_{SINK}=\frac{V_{PRTLIM}}{R_{PRTLIM}},\ \ I_{SOURCE}=\frac{R_{RNF}\times I_O}{R_{DET}}$$

Initial Detection of Over current and load current I_t (Threshold current), if I_{SINK} = I_{SOURCE} current, can be computed using the following:

$$I_{SINK}=I_{SOURCE}$$

$$\frac{V_{PRTLIM}}{R_{PRTLIM}}=\frac{R_{RNF}\times I_t}{R_{DET}}$$

$$I_t=\frac{R_{DET}}{R_{PRTLIM}}\times\frac{V_{PRTLIM}}{R_{RNF}}$$

If I_{SINK} < I_{SOURCE}, the time for error detect flag t_d: time until PRTF / PRTT voltage reaches 3.0V (Typ) can be computed using the following equations:

$$C\times V_d=(I_{SOURCE}-I_{SINK})\times t_d$$

$$t_d=\frac{C\times V_d}{I_{SOURCE}-I_{SINK}}$$

$$t_d=\frac{C\times V_d}{\frac{R_{RNF}\times I_O}{R_{DET}}-\frac{V_{PRTLIM}}{R_{PRTLIM}}}$$

If (V_d = V_{PRTDET} − V_{PRTREF} = 3.0 − 1.06 = 1.94 V)
Ex) t_d = 100ms, I_O = 200mA, I_t = 100mA, RNF = 0.5Ω, R_2 = 47kΩ, R_1 and C are:

$$R_{DET}=\frac{R_{PRTLIM}\times R_{RNF}}{V_{PRTLIM}}\times I_t=\frac{47\text{k}\times 0.5}{0.53}\times 100\text{m}=4.4\ \ [\text{k}\Omega]$$

$$C=\frac{t_d}{V_d}\times\left(\frac{R_{RNF}\times I_O}{R_{DET}}-\frac{V_{PRTLIM}}{R_{PRTLIM}}\right)=\frac{100\text{m}}{1.94}\times\left(\frac{0.5\times 200\text{m}}{4.4\text{k}}-\frac{0.53}{47\text{k}}\right)=0.59\ \ [\mu\text{F}]$$

After the protection detection, the time t_{dc} that the PRTF/PRTT capacitor voltage takes to discharge to the default 1.06V, can be computed using the following equations:

$$C\times V_d=I_{SINK}\times t_{dc}$$

$$t_{dc}=\frac{C\times V_d}{I_{SINK}}=\frac{C\times(V_{PRTDET}-V_{PRTREF})R_{PRTLIM}}{V_{PRTLIM}}=\frac{0.59\times(3.00-1.06)\times 47\text{k}}{0.53}=102\ \ [\text{ms}]$$

If Actuator Over current protection function is not in use, then it is recommended that each terminal is set as follows. However, there will be no problem if we connect RPRTLIM of PRTLIM terminal.

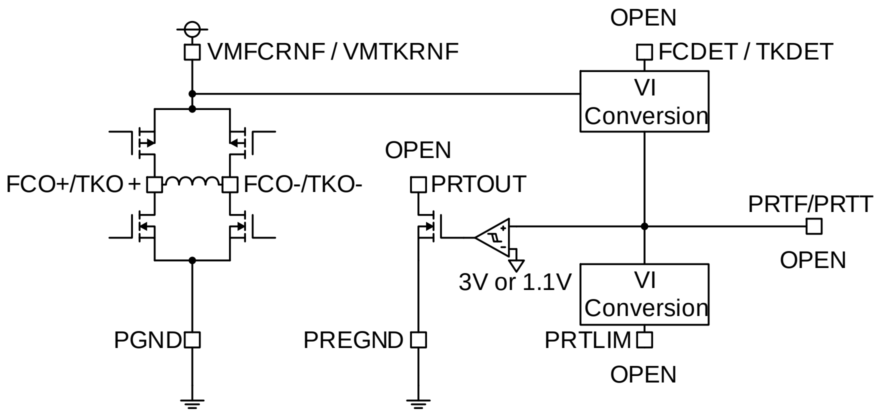


Figure 20. Configuration Example when OCP is not in use

7. Loading Driver

(1) Loading driver basic operation description

This is the single input BTL drive system.
Loading driver will be active when CTL1=High and CTL2=Low.
Output will be Hi-z when VC<0.7V
Loading function table:

INPUT	OUTPUT
LDIN＞VC	Forward
LDIN＜VC	Reverse
LDIN=VC	Brake [(VCC-V_f)/2]

(2) Voltage Gain Calculation

The output Voltage is set by Input voltage (LDIN – VC) x Voltage gain (G_{VLD})
Voltage can be adjusted by external input resistor Rin.

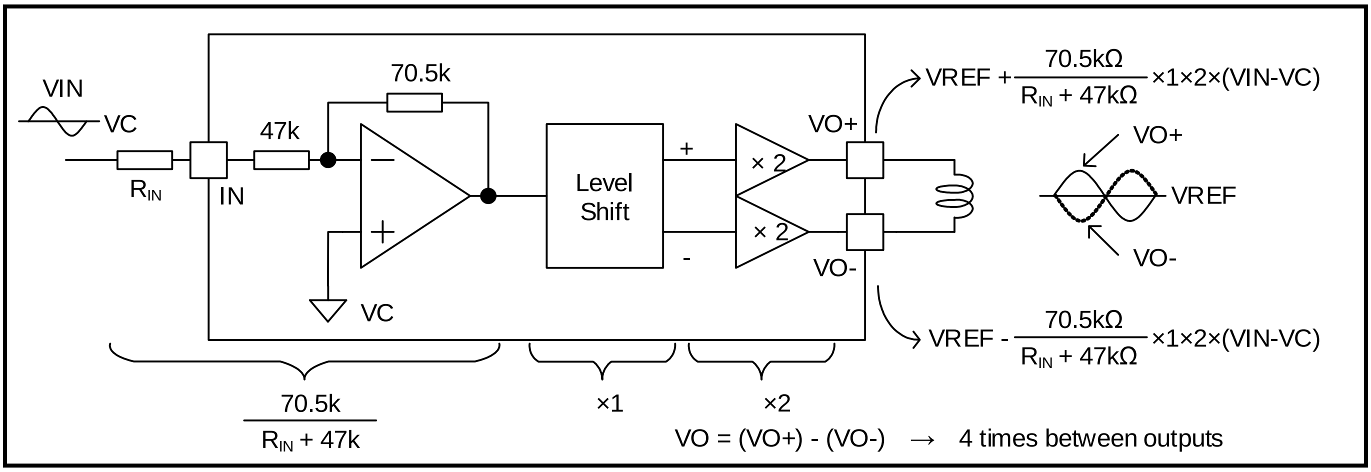


Figure 21.Loading Closed Loop Voltage Gain Calculation Diagram

Voltage gain is given by following formula

$$G_{VLD} = \frac{VO}{VIN} = \frac{70.5\mathrm{k}}{R_{IN}+47\mathrm{k}} \times 1 \times 2 \times 2 \ \text{[dB]}$$

When RIN = 0

$$G_{VLD} = \frac{VO}{VIN} = \frac{70.5\mathrm{k}}{47\mathrm{k}} \times 1 \times 2 \times 2 = 15.6 \ \text{[dB]}$$

(3) Loading driver VCC-short or GND-Short protection function

The IC has the ability to prevent the destruction of the POWER MOS output when destructive conditions happen.

(a) When the low side power MOS is ON, it is VCC-short protected when the output pin voltage is more than (power -2V_f), and when current at VCC short is detected at the same time. During this time, output goes OFF and after 100us, output become active to check if short persists. If VCC-short mode continues, Output goes OFF again.
2V_f = around 1.4V(Typ).

(b)When the high side power MOS is ON , when output pin voltage is less than 2V_f , and detects a ground fault current, a ground fault protection is done, and output goes OFF. After 100us, output become active. If short mode continues, Output goes OFF again. Also, the current depends on the output voltage ground fault sensing

Supply and GND fault protection circuit has a built in filter to remove high frequency noise of 20us.
Driving current is limited according to the truth table below:

Drive Condition	OUTPUT Voltage	OUTPUT Short Current	Detect Condition	OUTPUT Mode
Low Side Output Power MOS ON	Greater Than VCC-2V_f	Flow	VCC – Short	Active to MUTE
High Side Output Power MOS ON	Less Than 2Vf	Flow	GND – Short	Active to MUTE

8. SLED Driver

(1) Input-Output Gain, Output Current Limit

The relation between the input voltage (V_{SL1IN}, V_{SL2IN}) and the output current detection terminals input voltage (V_{VM_S}-V_{SLRNF}) is expressed as shown below:

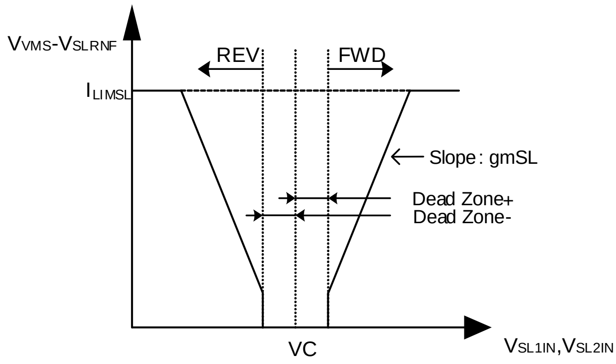


Figure 22.SLED Motor input –Output Characteristic

The Input-Output Gain (gm_{SL}) and the output-limit current (I_{LIMSL}) depend on the resistance of $R_{SLRNF1,2}$ (output current detection resistor).
The gain for SLED motor can be adjusted by input resistance (Rin).
Please refer to the following formula.

▼Input-Output Gain, Output Current Limit (Typ)

Input-Output Gain	$gm_{SL} = 0.33/R_{SLRNF}$ [A/V]
Output-limit current	$I_{LIMSL} = 0.25/R_{SLRNF}$ [A]
Input-Output Gain With Resistor Connected	$gm_{SL} = (47\text{k}/(R_{IN} + 47\text{k})) \times (0.33/R_{SLRNF})$ [A/V] (R_{IN} =External Input Resistance)

(2)SLED Input-Output Gain Formula

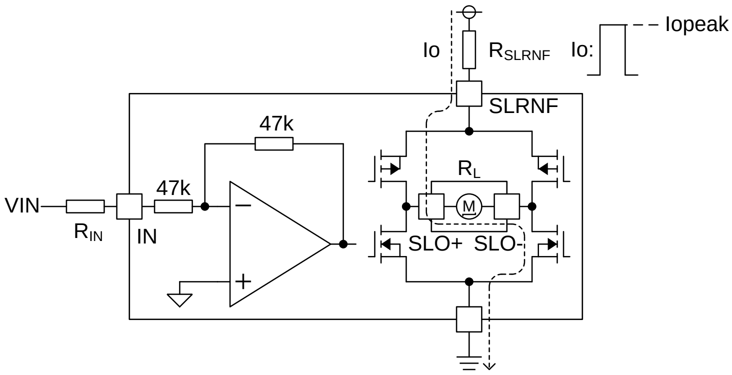


Figure 23.SLED Motor Input-Output Gain calculation

Input-Output Gain calculation expression is given by the following formula.

$$gm_{SL} = \frac{Iopeak}{VIN} = \frac{47\text{k}}{R_{IN}+47\text{k}} \times \frac{0.33}{R_{SLRNF}} \quad \text{[A/V]}$$

$$\frac{Vopeak}{VIN} = \frac{47\text{k}}{R_{IN}+47\text{k}} \times \frac{0.33}{R_{SLRNF}} \times R_L \quad \text{[V/V]}$$

It will be given by the following formula if you do not use the RIN.

$$gm_{SL} = \frac{Iopeak}{VIN} = \frac{0.33}{R_{SLRNF}} \quad \text{[A/V]}$$

(3) Output Pin State

Output State of SLED motor when input dead zone detected and current limit detected is given below

▼ Output Pin State

Input Dead Zone Detected	Short Brake (Note1)
Current Limit Detected	Short Brake (Note1)

(Note 1) Short brake is the state where both the Positive and negative output of the driver will be pulled to high

(4) SLED Driver Operation Description

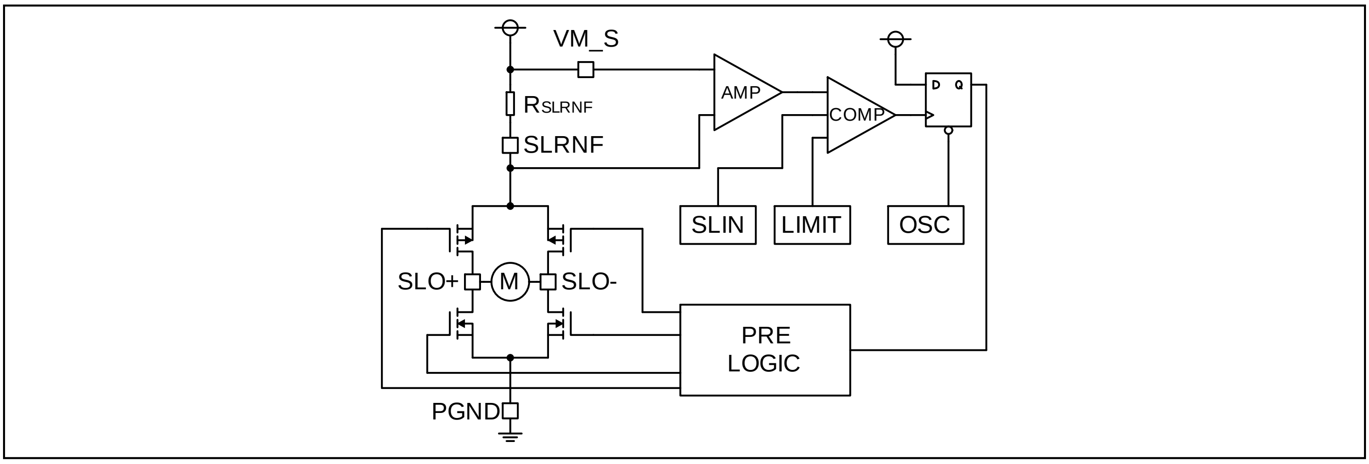


Figure 24.SLED Motor Block Diagram

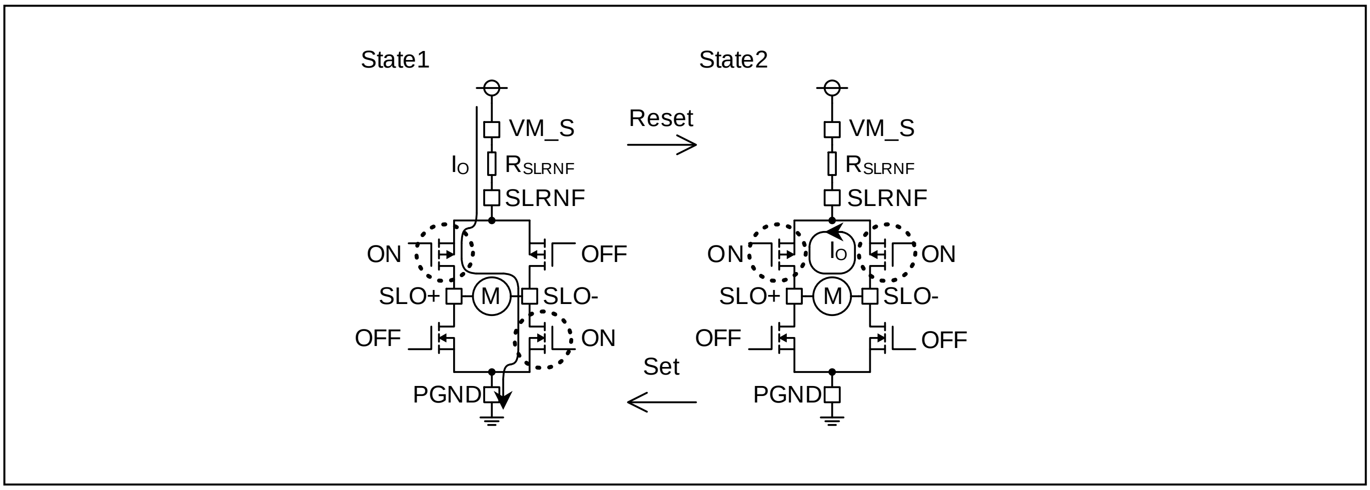


Figure 25. Set[State 1], Reset[State 2] to Current Load

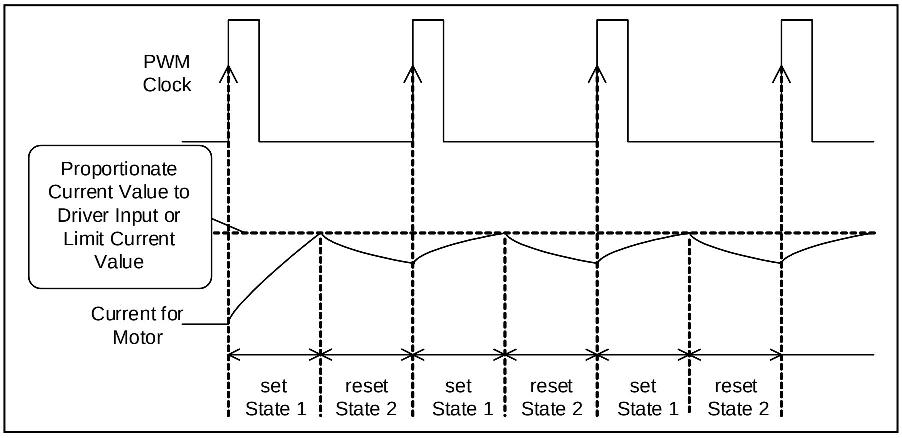


Figure 26. SLED Motor Driver Operation Timing Chart

Set [State1] : As PWM clock starts pulsing, the output turns ON and load current is supplied by VCC.

Reset[State2] : The output turns OFF when the increasing load current reaches the current value proportional to driver input or limit current value. The increase in the load current is caused by the L component of the motor when operating during this state as shown in Figure 25. State 2.

9. Spindle Driver

(1) Input-Output Gain, Output Current Limit

The relation between the torque command input voltage (V_{SPIN}) and the output current detection terminals input voltage (V_{VM_S}-V_{SPRNF}) is expressed as shown below:

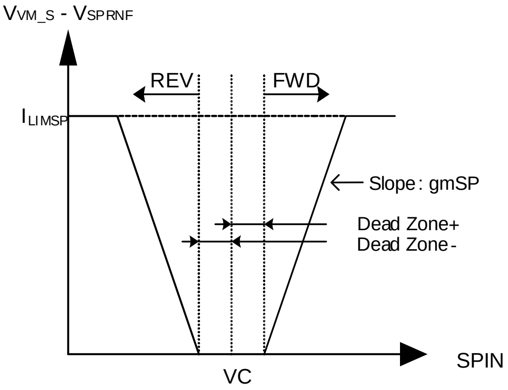


Figure 27. Spindle Input-Output Characteristics

The Input-Output Gain (gm_{SP}) and the output-limit current (I_{LIMSP}) depend on the resistance of R_{SPRNF} (output current detection resistor).
The gain for Spindle motor can be adjusted by input resistance (Rin).
Please refer to the following formula.

▼Input-Output Gain, Output Current Limit (Typ)

Input-Output Gain	$gm_{SP} = 0.339/R_{SPRNF}$ [A/V]
Input-Output Gain With Resistor Connected	$gm_{SP} = (47k/(R_{IN}+47k)) \times (0.339/R_{SPRNF})$ [A/V] (R_{IN} =External Input Resistance)
Output-Limit Current	$I_{LIMSP} = 0.247/R_{SPRNF}$ [A]

(2)Spindle Input-Output Gain Formula

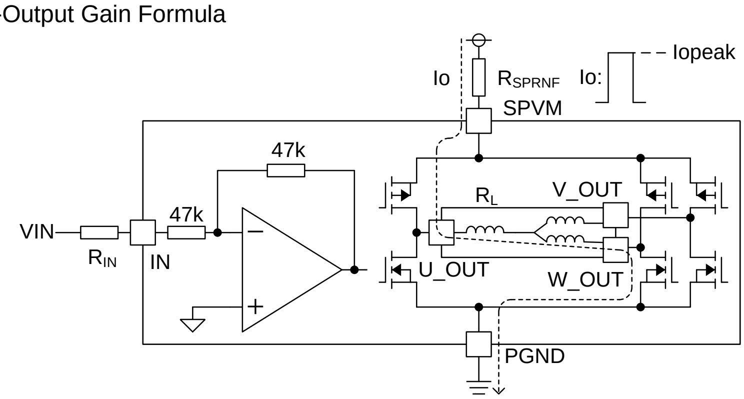


Figure 28. Spindle Driver Load Current Path

Input-Output Gain calculation expression is given by the following formula.

$$gm_{SP} = \frac{Iopeak}{VIN} = \frac{47k}{R_{IN}+47k} \times \frac{0.339}{R_{SPRNF}} \text{ [A/V]}$$

$$\frac{Vopeak}{VIN} = \frac{47k}{R_{IN}+47k} \times \frac{0.339}{R_{SPRNF}} \times R_L \text{ [V/V]}$$

It will be given by the following formula if you do not use the RIN.

$$gm_{SP} = \frac{Iopeak}{VIN} = \frac{0.339}{R_{SPRNF}} \text{ [A/V]}$$

(3) Output Pin State

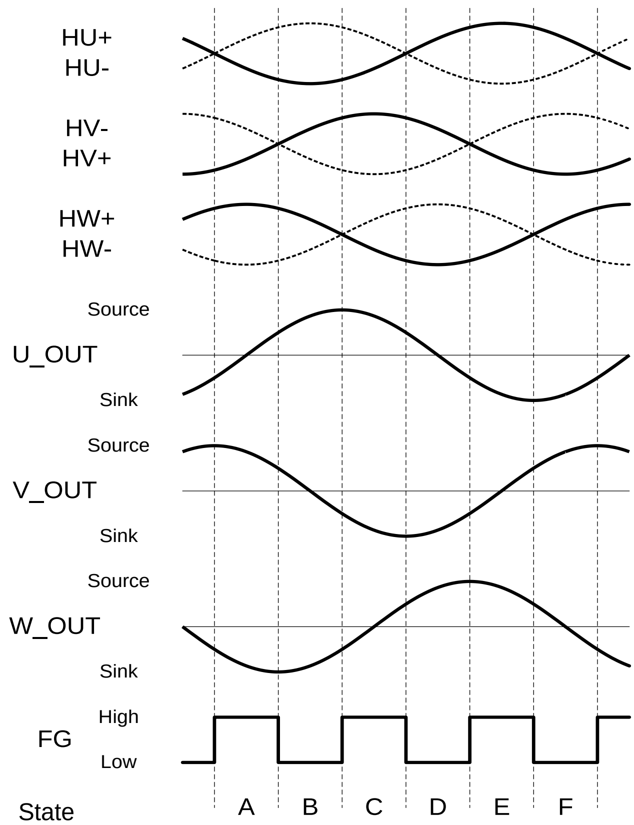
Output State of Spindle motor when input dead zone detected and current limit detected is given below

▼ Output Pin State

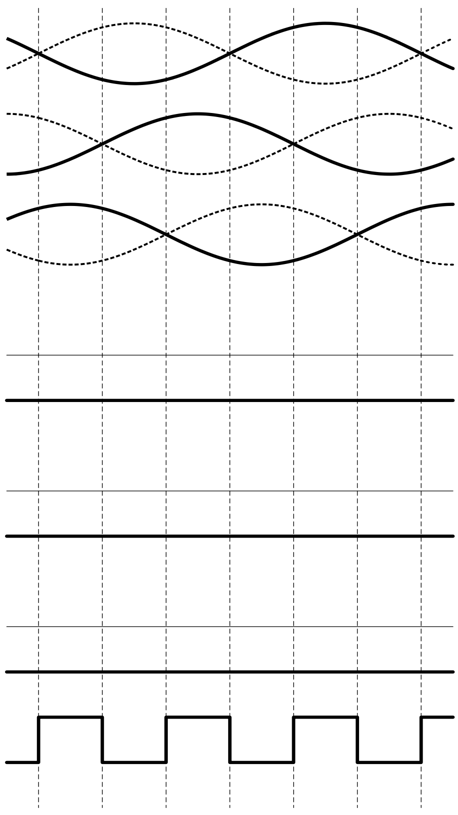
Input Dead Zone Detected	Short Brake (Note1)
Current Limit Detected	Short Brake (Note1)

(Note 1) In short brake mode outputs U_OUT, V_OUT, and W_OUT voltages will be low.

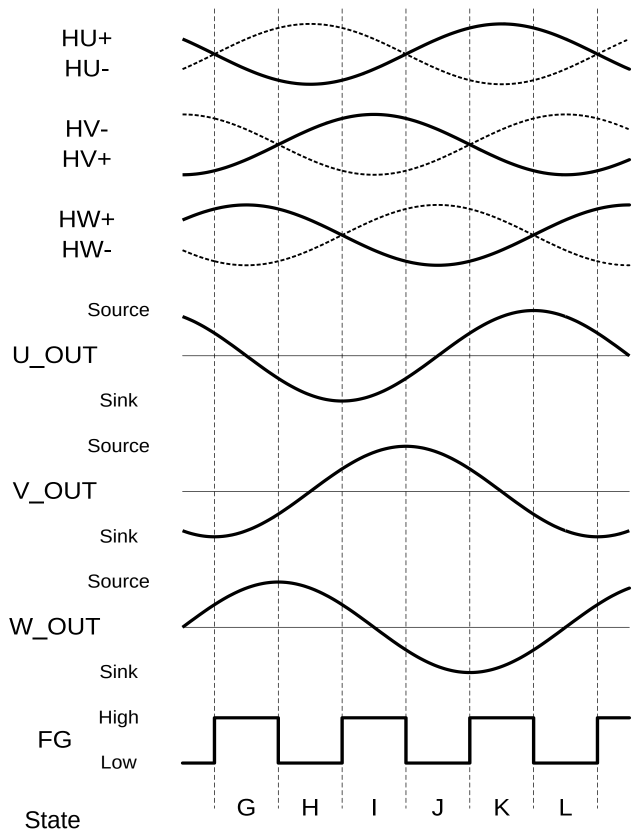
(4) Input / Output Timing Chart of Spindle Driver



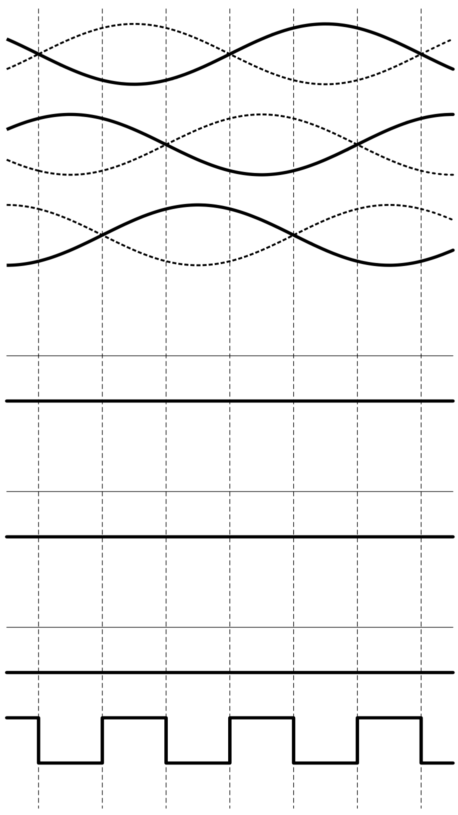
(a) Forward Rotation Mode
(SPIN>VC)



(b) Short Brake Mode
(SPIN<VC, CTL1=CTL2=H)



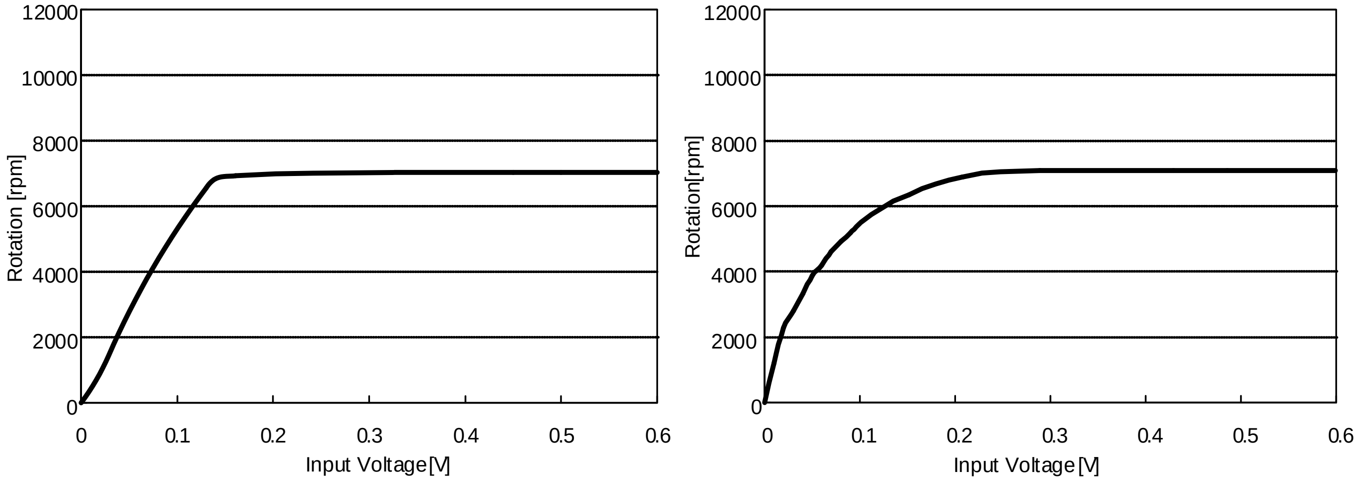
(c) Reverse Rotation Brake Mode
(SPIN<VC, CTL1=L, CTL2=H, Before Reverse Detection)



(d) Reverse Protection Mode
(SPIN<VC, CTL1=L, CTL2=H, After Reverse Detection)

(5) Spindle Driver Input-Output Specifications

Figure 29. shows the input and output characteristics of the peak current detection control and the average current detection control. This IC uses the peak current detection output control. Comparing Figure 29. (a) and (b), the linearity of the input-output characteristic has been improved compared to the average current detection method.



(a) Peak Current Control (BD8253EFV-M) (b) Average Current Control

Figure 29. Spindle Driver Input-Output Specifications

The difference between the input and output characteristics caused by the change in the detection control method can be explained as follows:

The coil of the motor is not only composed of pure inductance, also includes an impedance component. Here, when the peak value of the output pulse is V_O, current I_O flowing through the motor at the output ON pulse is expressed as follows:

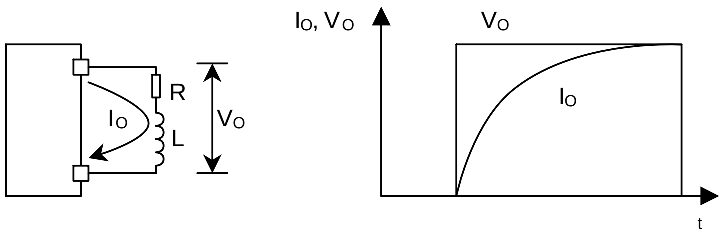


Figure 30. Current Waveform Including Impedance Elements

$$V_O = I_O(t) \times R + L \times \frac{dI_O(t)}{dt}$$

$$I_O = \frac{V_O}{R}\left(1 - e^{-\frac{R}{L}t}\right)$$

It can be seen from the above equation that the curve of the natural logarithm is the current flowing through the motor, I_O. The figure above shows the characteristic of the input voltage versus the current flowing through the motor control.

The speed of the spindle motor is proportional to the current flowing through the motor. In the case of the PWM driver, the current through the motor is equal to the peak current supplied by the driver and regenerated electrical current.

The average value of the current from the power supply (the integral value of the supply current) is proportional to the input voltage in the average current control method. The input current flowing through the motor (number of revolutions) is approximated by the curve of the natural logarithm (Figure 31.(b)). Therefore, the gain is higher in the low-speed rotation area.

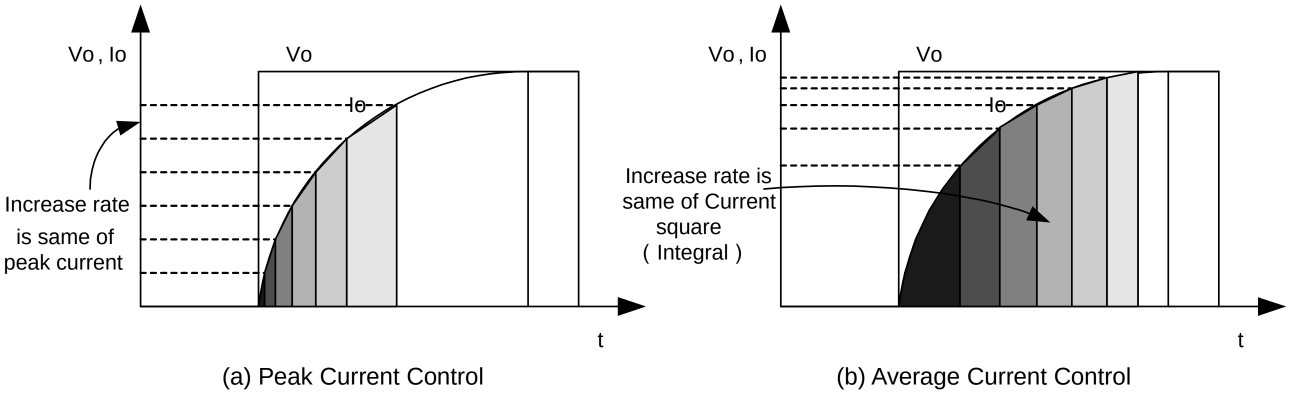


Figure 31: Input Voltage Versus Motor Current

(6) Current Limit Operation

Figure 32 shows the operation timing chart.

With this IC, the flip-flop is operated based on the clock generated from the built-in triangular wave, generating a PWM pulse. Spindle driver starts the operation with the rising edge of the clock. When the peak current due to the limit current or gain is detected, it enters short break state, and there is no output pulse until the next clock is entered. This operates by PWM oscillation frequency based on the same internal clock in either limit current detection or normal peak current detection.

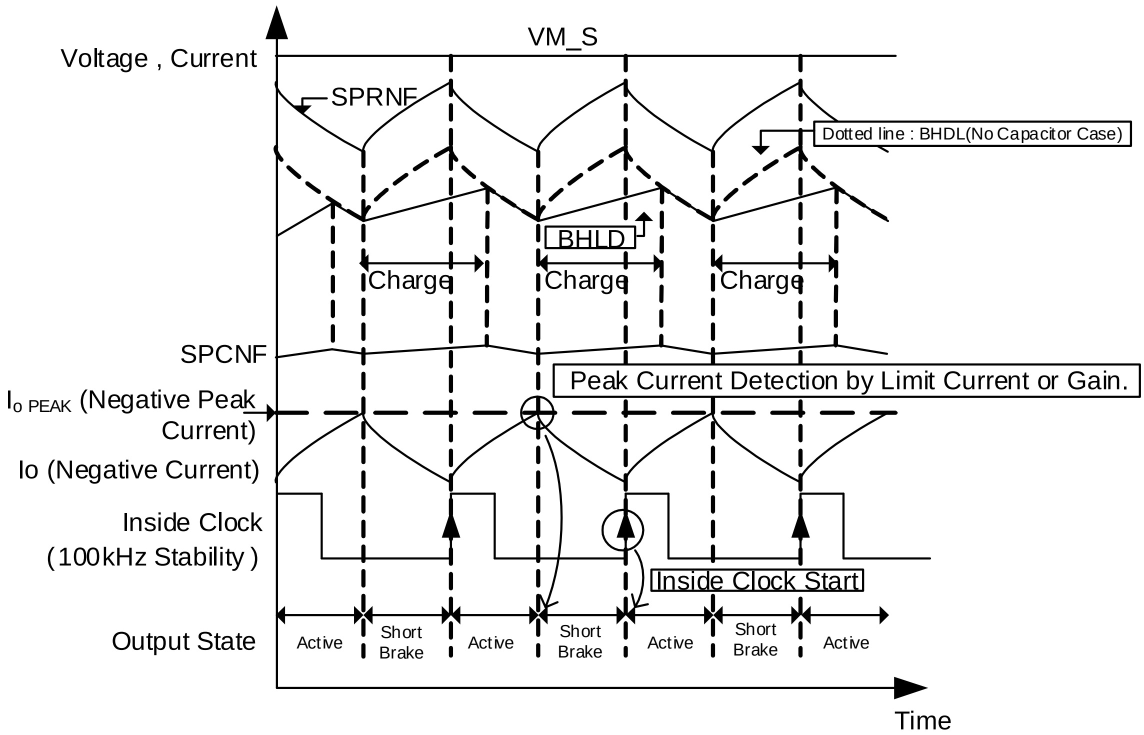


Figure 32. Spindle Driver Timing Chart

(7) Role of BHLD Pin, SPCNF Pin Capacitor

The block diagram of spindle driver is shown in the Figure 33.

This IC utilizes the current control system peak by the hold capacitor, C_{BHLD}, to monitor through the pin SPRNF the IO load current flowing through the spindle motor which is connected to the BHLD terminal. The charging time of the BHLD terminal is the time constant determined by the 50kΩ (Typ) internal resistance and the capacitor C_{BHLD}.

C_{SPCNF}, the capacitor of SPCNF pin, affects the cut-off frequency (f_C) of the spindle driver control loop. f_C is computed in the following equation: (where R_{ERROUT}=700Ω (Typ) which is the internal error amplifier output impedance).

$$f_c = \frac{1}{2\pi C_{SPCNF} R_{O\ ERR}}$$

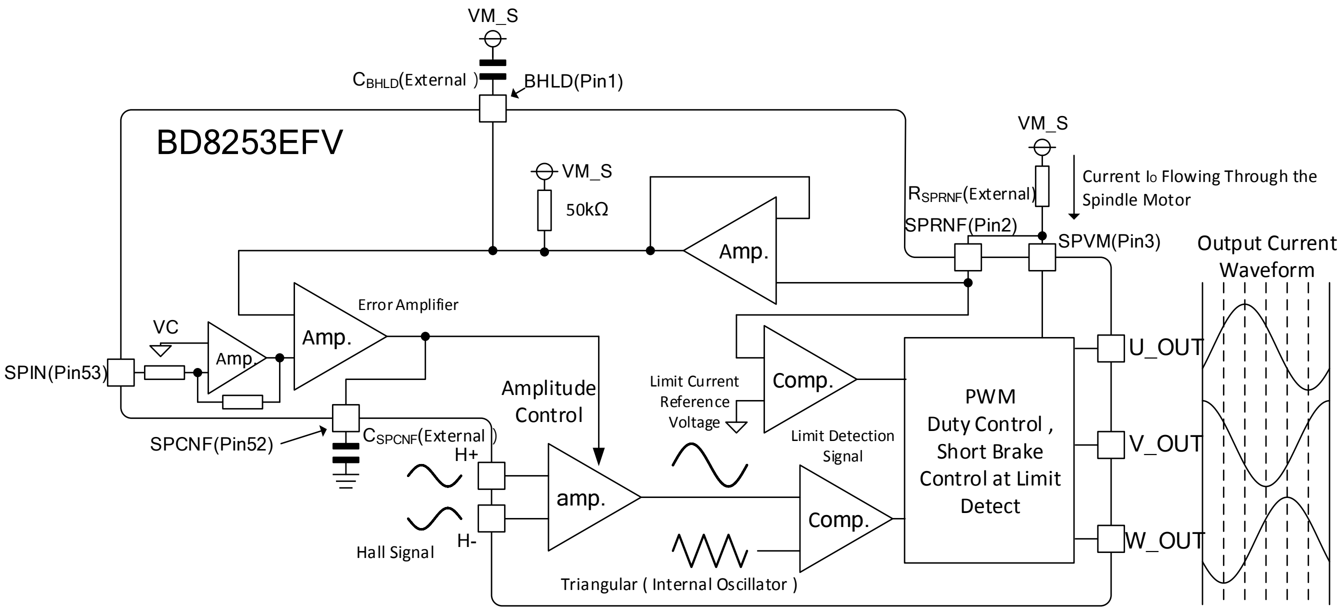


Figure 33. Spindle Driver Block Diagram

(8) Setting of Spindle Hall Signal

In this IC, Low noise (Silent) is achieved by controlling the output current in sine wave shape as shown in Figure 33. The output current is controlled by using a Hall signal which is amplified in response to SPIN input. If the amplitude of a hall signal is too small, the amplitude of output current may also become small and number of rotations may fall. Therefore, the input level of a hall signal shall be 50 mV or more (hall amplifier input level: VHIM) like Figure 34. Moreover, please make the hall signal waveform near a sine wave.

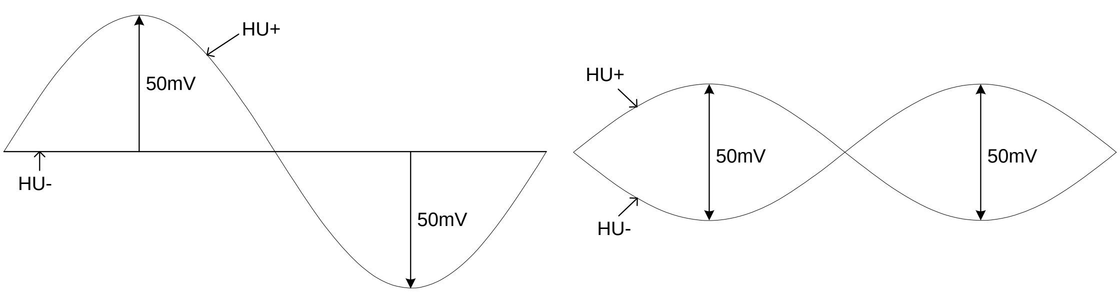
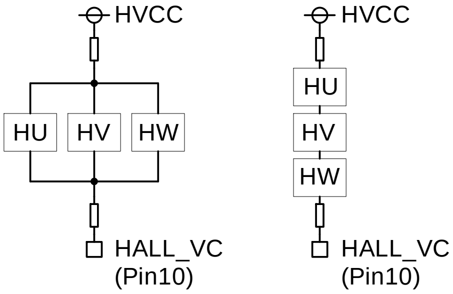


Figure 34. Minimum Value of Hall Input Amplitude (Example of HU+ and HU- Input)

(9) Hall Inputs (Pin 4to9) and Hall Bias (Pin 10) (For Spindle)
Hall elements can be connected either in series or parallel connection as shown in the Figure 35. Set the hall input voltage to 1.0V to 6.0V (Hall amplifier in phase input voltage range: V_{HICM}).



<Parallel Connection> <Series Connection>

Figure 35. Connection Example: Hall Element

(10) FG Pulse
3FG is the output of FG terminal. Set FG pull-up resistance to 3.3kΩ or less. If the resistance is more than 3.3kΩ, there is a possibility that the FG voltage become high to low when the Spindle output change to Hi-Z.
Because the output signal generated from the Hall signal, FG, may have a noise component riding it and the FG output pulse may have jitter noise. It is recommended to insert a capacitor (about 0.01µF) between the positive and negative Hall signal to prevent noise radiation from the flexible cable or from the board pattern.

(11) Reverse Brake Mode
When reverse brake is done, from high speed, take note of the counter-electromotive force. Also, consider the speed of motor rotation to ensure sufficient output current when using reverse brake.

(12) Capacitor Between SPVM-PGND
There is change in voltage and current because of the steep drive PWM. The capacitor between SPVM and PGND is placed in order to suppress the fluctuations due to the SPVM voltage. However, the capacitor effect is reduced if this capacitor is placed far from IC due to the effect of the line impedance. Therefore, this capacitor should be placed very close to the IC.

Noise Suppression

The following are possible causes of noise of the PWM driver.

A. Noise from the power line or GND line.

B. Radiated noise

1. Countermeasures Against A

(1) Reduce the wiring impedance on Power Supply and GND lines where high current flows. Make sure that they are separated from power supply lines of other devices so that they do not have common impedance. (Figure 36)

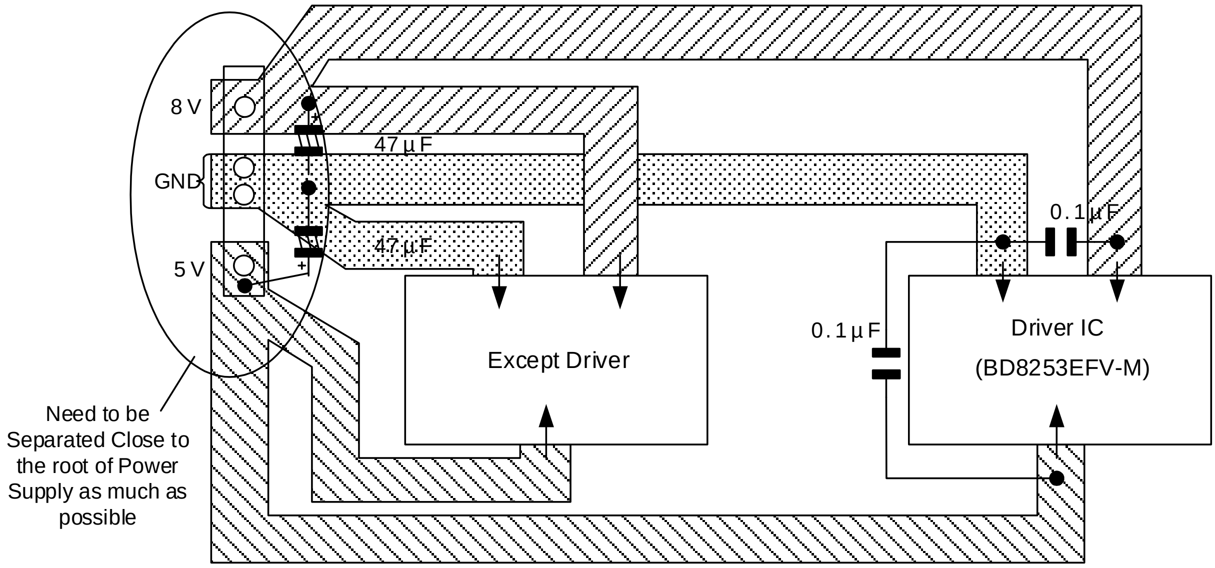


Figure 36. Example Pattern

(2) Provide a low ESR electrolytic capacitor between the power terminal and the ground terminal of the driver to achieve strong stabilization. Provide a ceramic capacitor with good high frequency property next to the IC. Also provide a ceramic capacitor with good high frequency property between SPRNF and GND. (Figure 37)
This can reduce power supply ripple due to PWM switching caused by the rotation of the spindle motor.

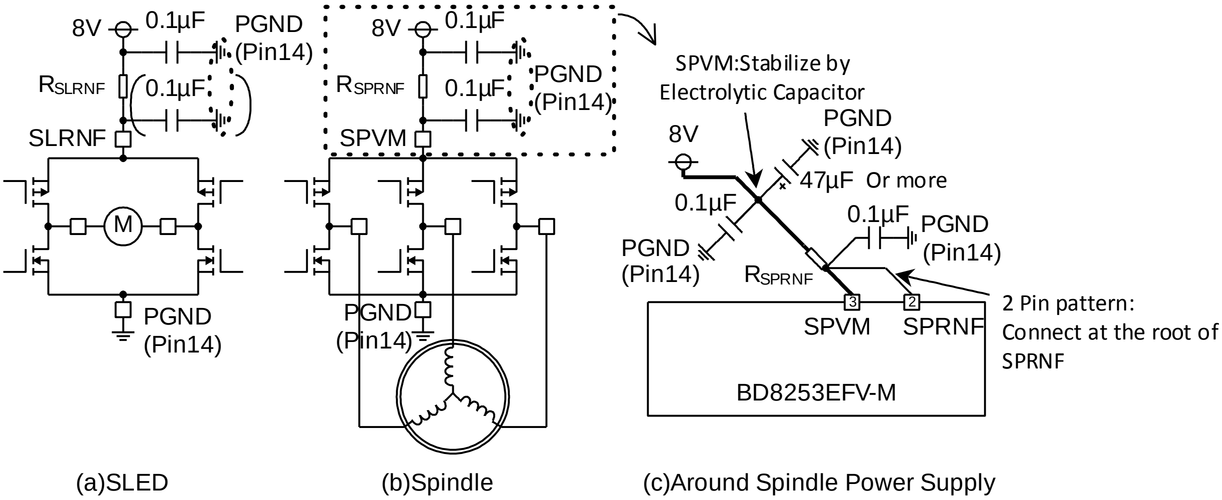


Figure 37. Position of Ceramic Capacitor

(3) If there's no improvement with the condition (1) and (2), another way is to insert an LC filter in the power line or GND line.

Example:

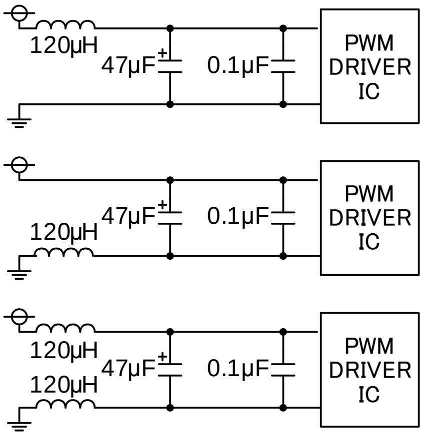


Figure 38. Example of LC Filter

(4) Another way is to add a capacitor of around 2200 pF between each output and the ground. In this case, ensure that the GND wiring should not have any common impedance with other signals. If a large capacitor is connected between output and GND, for some reasons when VCC is short circuited with OV or GND, the current from the charged capacitor flows to the output and it may be destroyed. Setting a capacitor between output and GND should be 0.1µF or less.

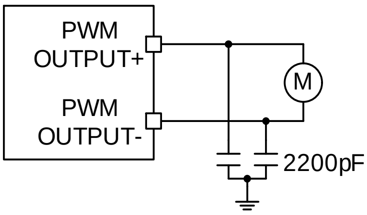


Figure 39. Snubber Circuit

2. Countermeasures Against B
   (1) Ensure certain distance between RF signal line and PWM-drive output line. If it's not possible to provide space between these lines, shield the RF signal line with a stable GND except power GND.
   (2) Same as (1), flexible cable for pickup should be shielded with GND in order to separate noise between the signal line and the actuator drive output line.
   (3) Separate the flexible cable for the motor and for the pickup.
   (4) Since the FG pulse is generated from the Hall signal, to avoid noise radiation on the flexible cable and the substrate pattern, the wiring stable GND or other low impedance ,Put shield between the PWM output and the Hall signal.

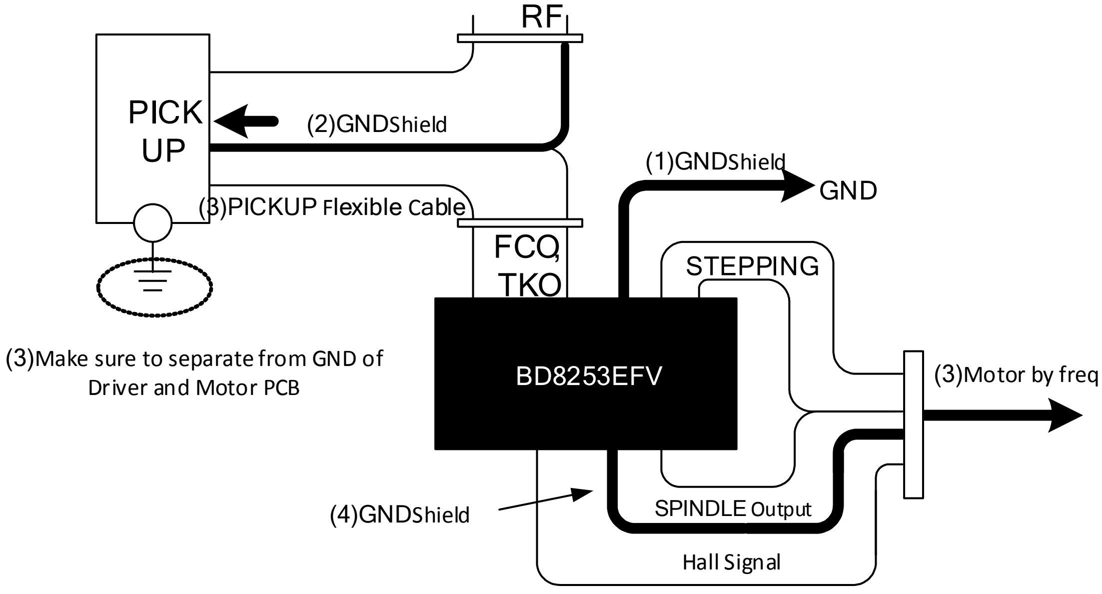


Figure 40. Countermeasure for RF Noise

Power Supply System

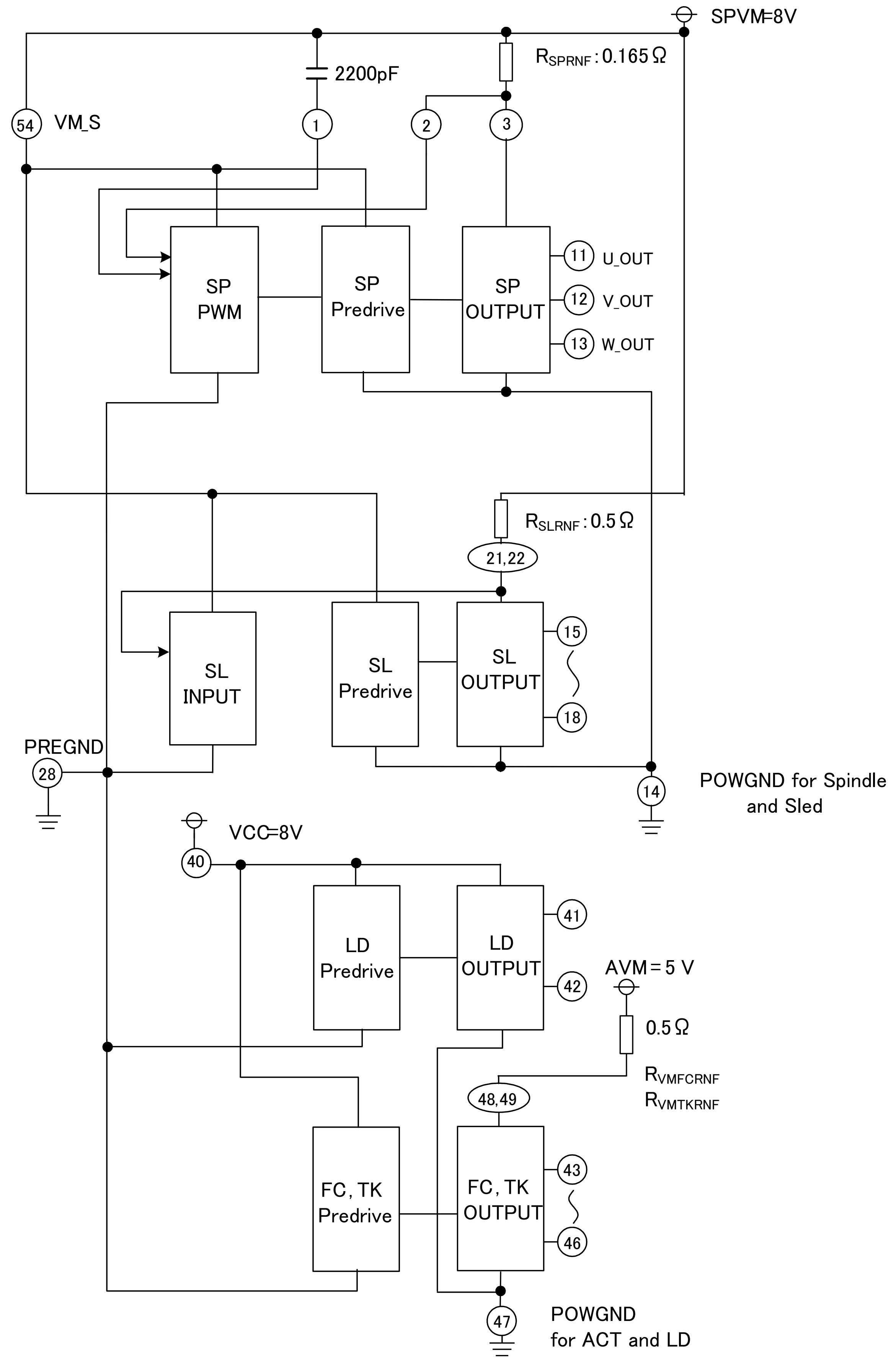


Figure 41. Internal Block Power Supply and GND Connection

Typical Application Circuit

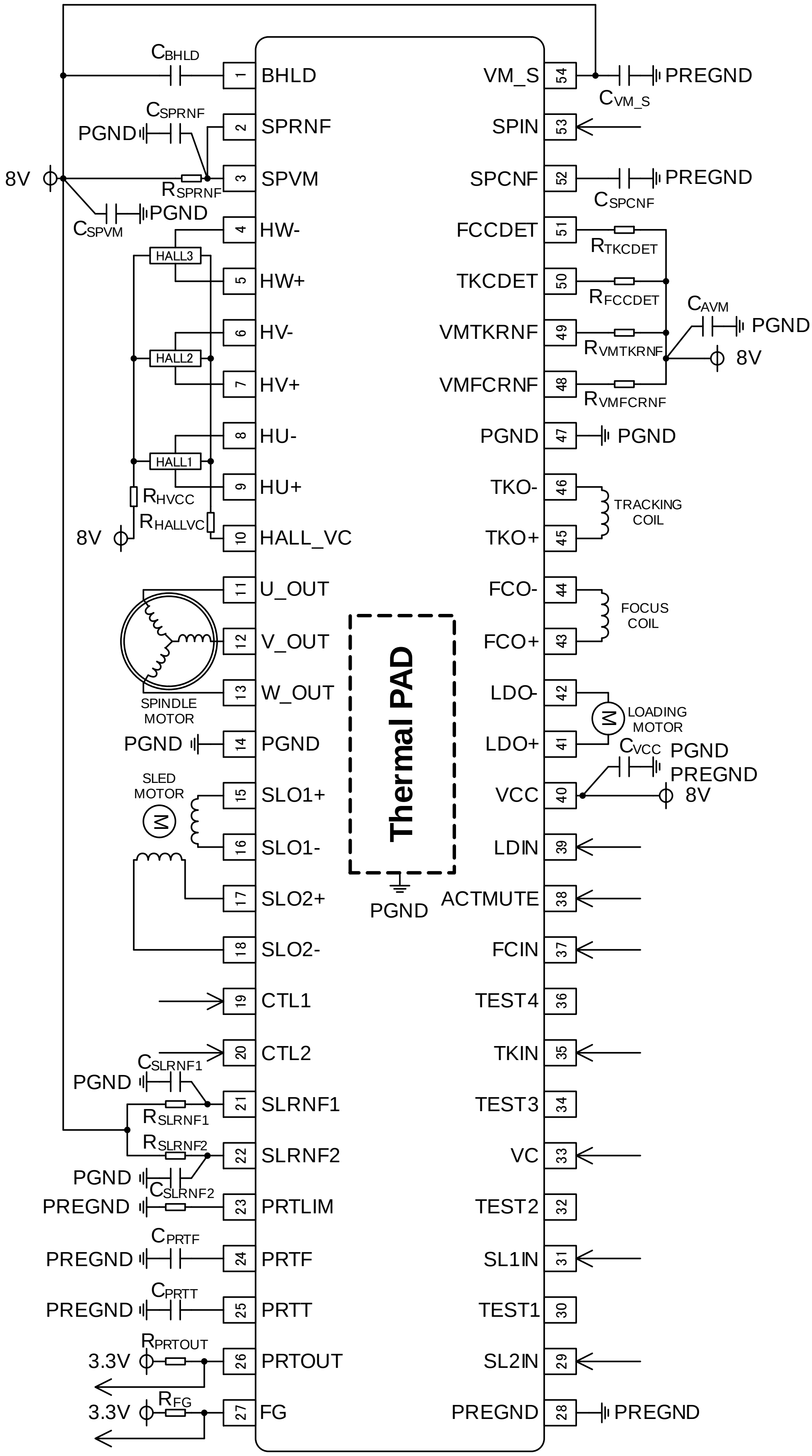


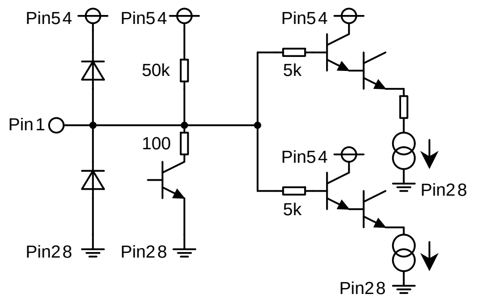
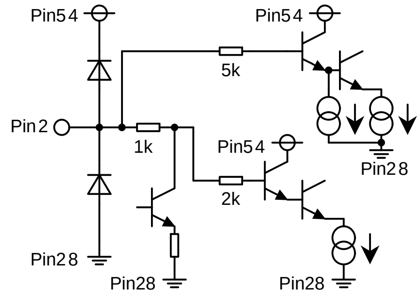
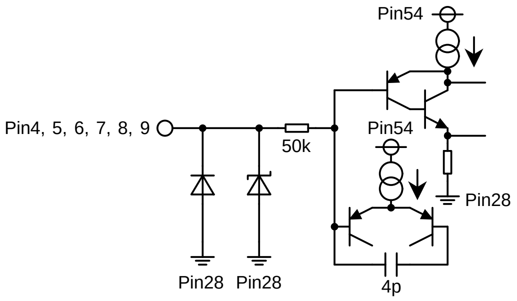
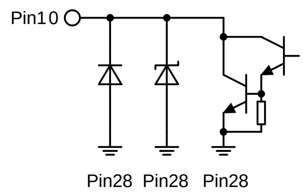
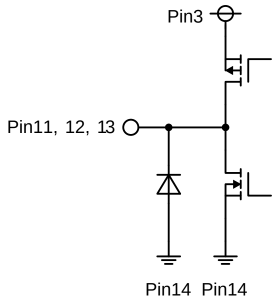
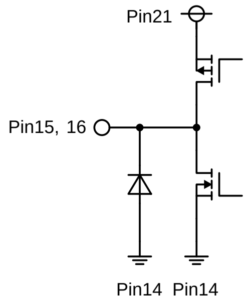
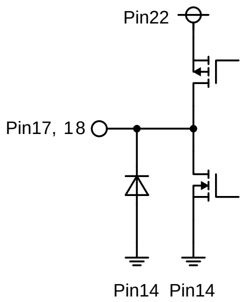
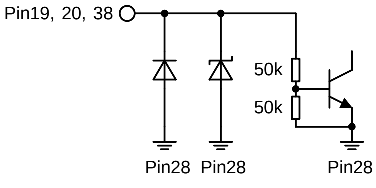
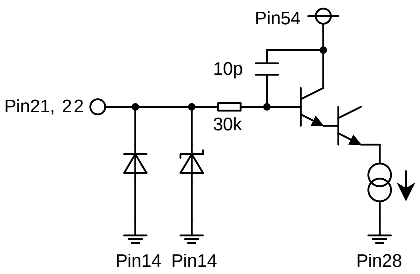
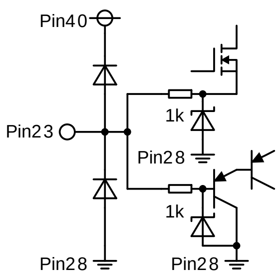
Figure 42. Application Circuit Example

▼Recommended Values

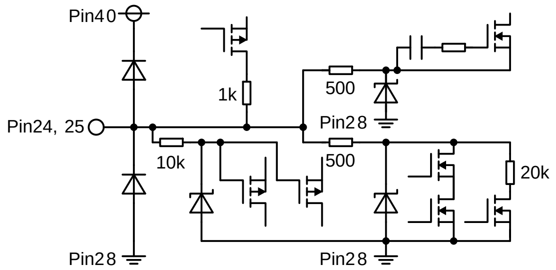
Component Name	Component Value	Product Name	Manufacturer
C_{VCC}	0.1μF	GCM188R11H Series	murata
	47μF	UCD1E470MCL	Nichicon
C_{VM_S}	0.1μF	GCM188R11H Series	murata
C_{BHLD}	2200pF	GCM188R11H Series	murata
C_{SPVM}	0.1μF	GCM188R11H Series	murata
	47μF	UCD1E470MCL	Nichicon
R_{SPRNF}	0.165Ω	MCR100 Series	Rohm
C_{SPRNF}	0.1μF	GCM188R11H Series	murata
C_{SPCNF}	0.01μF	GCM188R11H Series	murata
C_{AVM}	0.1μF	GCM188R11H Series	murata
	47μF	UCD1E470MCL	Nichicon
R_{TKRNF}	0.5Ω	MCR100 Series	Rohm
R_{TKCDET}	10kΩ	MCR03 Series	Rohm
R_{FCRNF}	0.5Ω	MCR100 Series	Rohm
R_{FCCDET}	10kΩ	MCR03 Series	Rohm
C_{PRTT}	0.1μF	GCM188R11H Series	murata
C_{PRTF}	0.1μF	GCM188R11H Series	murata
R_{SLRNF1}	0.56Ω	MCR100 Series	Rohm
R_{SLRNF2}	0.56Ω	MCR100 Series	Rohm
C_{SLRNF1}	0.1μF	GCM188R11H Series	murata
C_{SLRNF2}	0.1μF	GCM188R11H Series	murata
R_{HVCC}	100Ω	MCR03 Series	Rohm
R_{HALLVC}	100Ω	MCR03 Series	Rohm
R_{PRTLIM}	47kΩ	MCR03 Series	Rohm
R_{FG}	33kΩ	MCR03 Series	Rohm
R_{PRTOUT}	33kΩ	MCR03 Series	Rohm

1. VMTKRNF, VMFCRNF, VCC, SPRNF, SPVM, SLRNF1, and SLRNF2: These pins are power supply of large currents. So, use Capacitor between PGND to these pins.
2. VM_S, SPCNF, PRTF, PRTT: Since it is a small signal path , please insert the capacitor against PREGND.
3. The VCC terminal is a power supply terminal of the loading part. Since high current flows when carrying out loading operation, please insert a capacitor to PGND. When not carrying out loading operation and operating other spindles, SLED motor, and an actuator, a VCC terminal becomes a power supply of the Pre stage of these circuits.
   In this case, since high current does not flow, please insert a capacitor to PREGND.

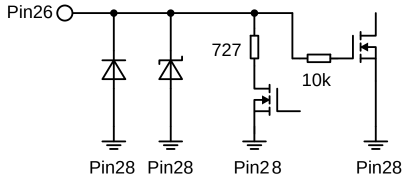
Terminal Equivalent Circuit (The value of resistors and capacitors are typical value)

1.BHLD	2.SPRNF
	
4.HW-, 5.HW+, 6HV-, 7HV+, 8.HU-, 9HU+	10.HALL_VC
	
11.U_OUT, 12.V_OUT, 13.W_OUT	15.SLO1+, 16.SLO1-
	
17.SLO2+, 18.SLO2-	19.CTL1, 20.CTL2, 38.ACTMUTE
	
21.SLRNF1, 22.SLRNF2	23.PRTLIM
	

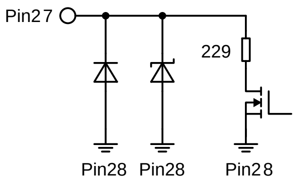
24.PRTF, 25.PRTT



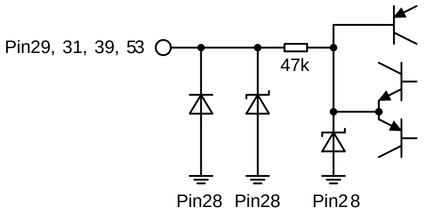
26.PRTOUT



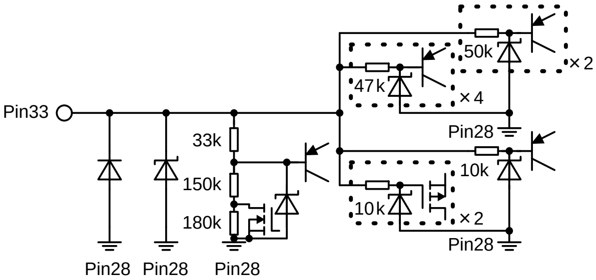
27.FG



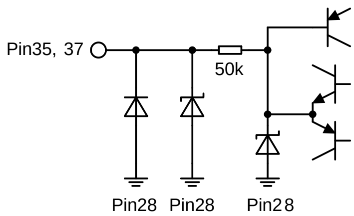
29.SL2IN, 31.SL1IN, 39.LDIN, 53.SPIN



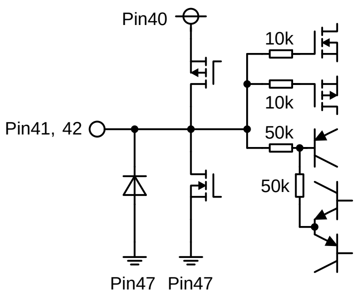
33.VC



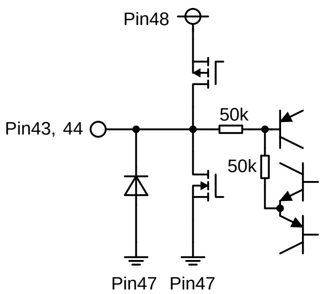
35.TKIN, 37.FCIN



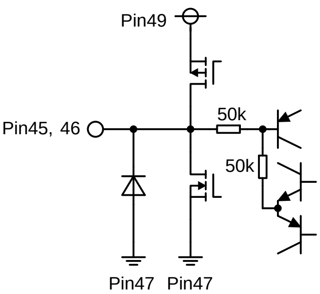
41.LDO+, 42.LDO-



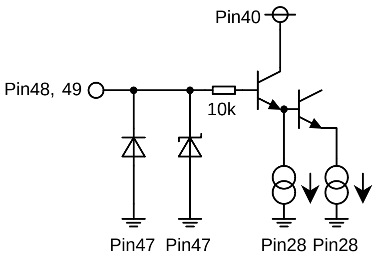
43.FCO+, 44.FCO-

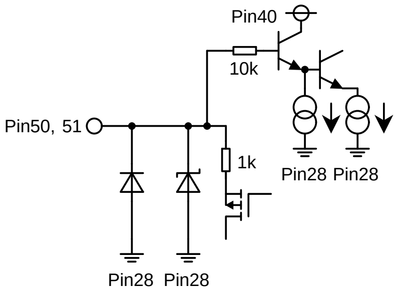
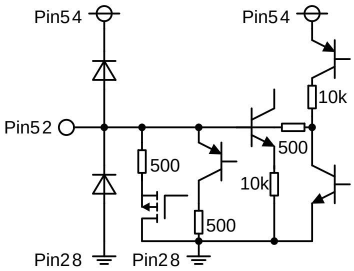


45.TKO+, 46TKO-



48.VMFCRNF, 49.VMTKRNF



50.TKCDET, 51.FCCDET	52.SPCNF
	

Operational Notes

1. **Reverse Connection of Power Supply**
   Connecting the power supply in reverse polarity can damage the IC. Take precautions against reverse polarity when connecting the power supply, such as mounting an external diode between the power supply and the IC's power supply pins.

2. **Power Supply Lines**
   Design the PCB layout pattern to provide low impedance supply lines. Separate the ground and supply lines of the digital and analog blocks to prevent noise in the ground and supply lines of the digital block from affecting the analog block. Furthermore, connect a capacitor to ground at all power supply pins. Consider the effect of temperature and aging on the capacitance value when using electrolytic capacitors.

3. **Ground Voltage**
   Ensure that no pins are at a voltage below that of the ground pin at any time, even during transient condition. However, pins that drive inductive loads (e.g. motor driver outputs, DC-DC converter outputs) may inevitably go below ground due to back EMF or electromotive force. In such cases, the user should make sure that such voltages going below ground will not cause the IC and the system to malfunction by examining carefully all relevant factors and conditions such as motor characteristics, supply voltage, operating frequency and PCB wiring to name a few.

4. **Ground Wiring Pattern**
   When using both small-signal and large-current ground traces, the two ground traces should be routed separately but connected to a single ground at the reference point of the application board to avoid fluctuations in the small-signal ground caused by large currents. Also ensure that the ground traces of external components do not cause variations on the ground voltage. The ground lines must be as short and thick as possible to reduce line impedance.

5. **Thermal Consideration**
   Should by any chance the maximum junction temperature rating be exceeded the rise in temperature of the chip may result in deterioration of the properties of the chip. In case of exceeding this absolute maximum rating, increase the board size and copper area to prevent exceeding the maximum junction temperature rating.

6. **Recommended Operating Conditions**
   These conditions represent a range within which the expected characteristics of the IC can be approximately obtained. The electrical characteristics are guaranteed under the conditions of each parameter.

7. **Inrush Current**
   When power is first supplied to the IC, it is possible that the internal logic may be unstable and inrush current may flow instantaneously due to the internal powering sequence and delays, especially if the IC has more than one power supply. Therefore, give special consideration to power coupling capacitance, power wiring, width of ground wiring, and routing of connections.

8. **Operation Under Strong Electromagnetic Field**
   Operating the IC in the presence of a strong electromagnetic field may cause the IC to malfunction.

9. **Testing on Application Boards**
   When testing the IC on an application board, connecting a capacitor directly to a low-impedance output pin may subject the IC to stress. Always discharge capacitors completely after each process or step. The IC's power supply should always be turned off completely before connecting or removing it from the test setup during the inspection process. To prevent damage from static discharge, ground the IC during assembly and use similar precautions during transport and storage.

Operational Notes – continued

10. Inter-pin Short and Mounting Errors

Ensure that the direction and position are correct when mounting the IC on the PCB. Incorrect mounting may result in damaging the IC. Avoid nearby pins being shorted to each other especially to ground, power supply and output pin. Inter-pin shorts could be due to many reasons such as metal particles, water droplets (in very humid environment) and unintentional solder bridge deposited in between pins during assembly to name a few.

11. Unused Input Pins

Input pins of an IC are often connected to the gate of a MOS transistor. The gate has extremely high impedance and extremely low capacitance. If left unconnected, the electric field from the outside can easily charge it. The small charge acquired in this way is enough to produce a significant effect on the conduction through the transistor and cause unexpected operation of the IC. So unless otherwise specified, unused input pins should be connected to the power supply or ground line.

12. Regarding the Input Pin of the IC

This monolithic IC contains P+ isolation and P substrate layers between adjacent elements in order to keep them isolated. P-N junctions are formed at the intersection of the P layers with the N layers of other elements, creating a parasitic diode or transistor. For example (refer to figure below):

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

Parasitic diodes inevitably occur in the structure of the IC. The operation of parasitic diodes can result in mutual interference among circuits, operational faults, or physical damage. Therefore, conditions that cause these diodes to operate, such as applying a voltage lower than the GND voltage to an input pin (and thus to the P substrate) should be avoided.

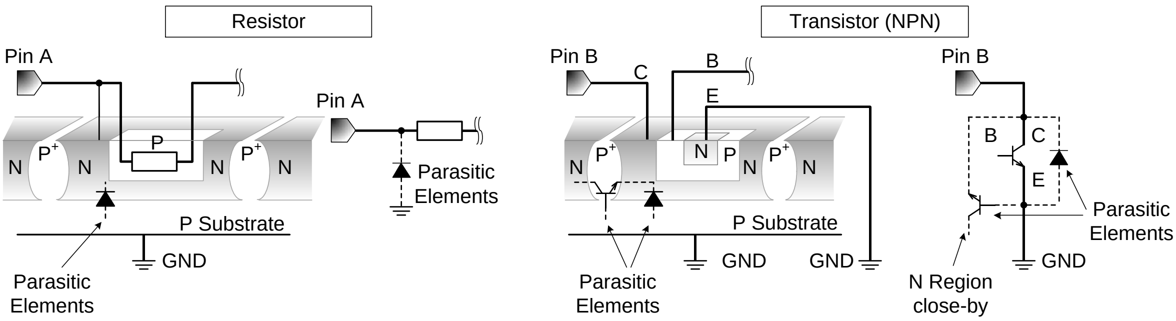


Figure 43. Example of monolithic IC structure

13. Ceramic Capacitor

When using a ceramic capacitor, determine the dielectric constant considering the change of capacitance with temperature and the decrease in nominal capacitance due to DC bias and others.

14. Area of Safe Operation (ASO)

Operate the IC such that the output voltage, output current, and the maximum junction temperature rating are all within the Area of Safe Operation (ASO).

15. Thermal Shutdown Circuit(TSD)

This IC has a built-in thermal shutdown circuit that prevents heat damage to the IC. Normal operation should always be within the IC's maximum junction temperature rating. If however the rating is exceeded for a continued period, the junction temperature (Tj) will rise which will activate the TSD circuit that will turn OFF all output pins. When the Tj falls below the TSD threshold, the circuits are automatically restored to normal operation.
Note that the TSD circuit operates in a situation that exceeds the absolute maximum ratings and therefore, under no circumstances, should the TSD circuit be used in a set design or for any purpose other than protecting the IC from heat damage.

Ordering Information

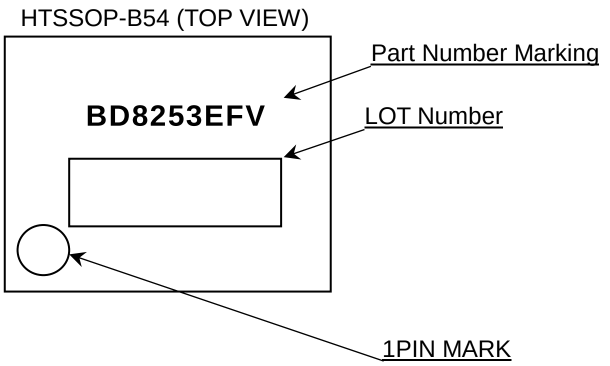
B	D	8	2	5	3	E	F	V	-	M	E	2

Part Number

Package
EFV : HTSSOP-B54

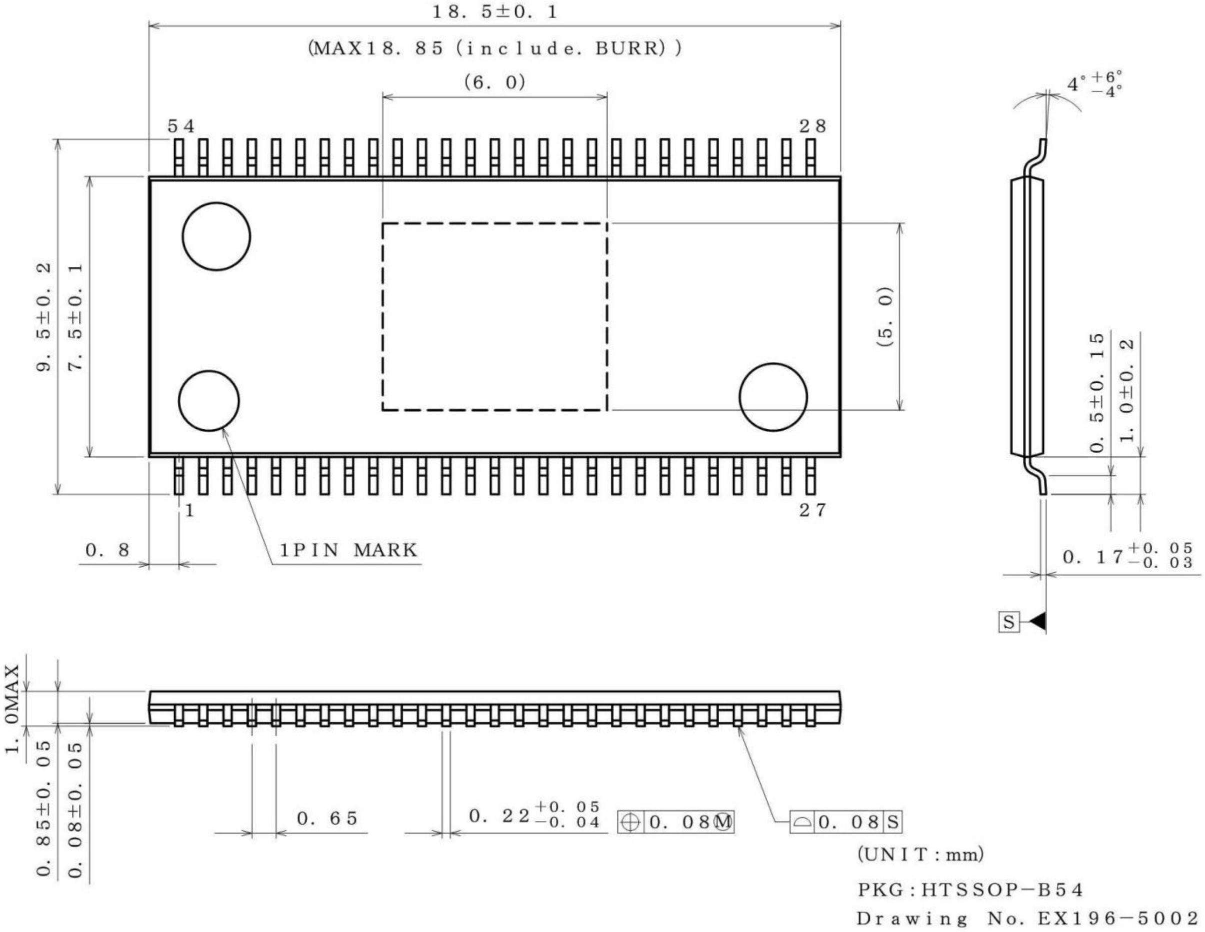
Product Rank
M : for Automotive
Packaging Specification
E2 : Embossed tape and reel

Marking Diagrams



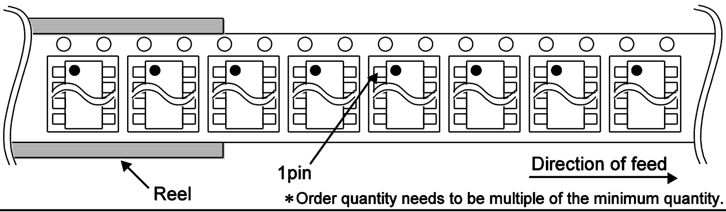
Physical Dimension, Tape and Reel Information

Package Name	HTSSOP-B54



<Tape and Reel information>

Tape	Embossed carrier tape (with dry pack)
Quantity	1500pcs
Direction of feed	E2 (The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand)



∗Order quantity needs to be multiple of the minimum quantity.

Revision History

Date	Revision	Changes
2016.1.26	001	New Release

Notice

Precaution on using ROHM Products

1. If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment (Note 1), aircraft/spacecraft, nuclear power controllers, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

2. ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
   [a] Installation of protection circuits or other protective devices to improve system safety
   [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

3. Our Products are not designed under any special or extraordinary environments or conditions, as exemplified below. Accordingly, ROHM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any ROHM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc, prior to use, must be necessary:
   [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
   [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
   [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
   [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
   [f] Sealing or coating our Products with resin or other coating materials
   [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
   [h] Use of the Products in places subject to dew condensation

4. The Products are not subject to radiation-proof design.

5. Please verify and confirm characteristics of the final or mounted products in using the Products.

6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse. is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7. De-rate Power Dissipation depending on ambient temperature. When used in sealed area, confirm that it is the use in the range that does not exceed the maximum junction temperature.

8. Confirm that operation temperature is within the specified range described in the product specification.

9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

Precaution for Mounting / Circuit board design

1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2. In principle, the reflow soldering method must be used on a surface-mount products, the flow soldering method must be used on a through hole mount products. If the flow soldering method is preferred on a surface-mount products, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

Precautions Regarding Application Examples and External Circuits

1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

2. You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

Precaution for Electrostatic

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
   [a] the Products are exposed to sea winds or corrosive gases, including Cl2, H2S, NH3, SO2, and NO2
   [b] the temperature or humidity exceeds those recommended by ROHM
   [c] the Products are exposed to direct sunshine or condensation
   [d] the Products are exposed to high Electrostatic

2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

Precaution for Product Label

A two-dimensional barcode printed on ROHM Products label is for ROHM's internal use only.

Precaution for Disposition

When disposing Products please dispose them properly using an authorized industry waste company.

Precaution for Foreign Exchange and Foreign Trade act

Since concerned goods might be fallen under listed items of export control prescribed by Foreign exchange and Foreign trade act, please consult with ROHM in case of export.

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BD8253EFV-M - Web Page

Part Number	BD8253EFV-M
Package	HTSSOP-B54
Unit Quantity	1500
Minimum Package Quantity	1500
Packing Type	Taping
Constitution Materials List	inquiry
RoHS	Yes