

HIGH-VOLTAGE MONOLITHIC IC

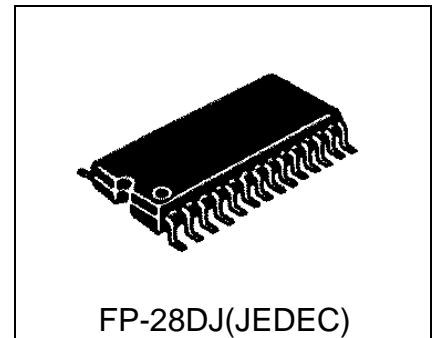
ECN3054

ECN3054 is a single chip driver IC which has 6 MOS-Gated devices for its output. It is suitable for controlling 3-phase brushless DC motors and 3-phase induction motors.

Functions

- Lower arm Over current (OC) Protection
- Under voltage Protection
- Fault Output function

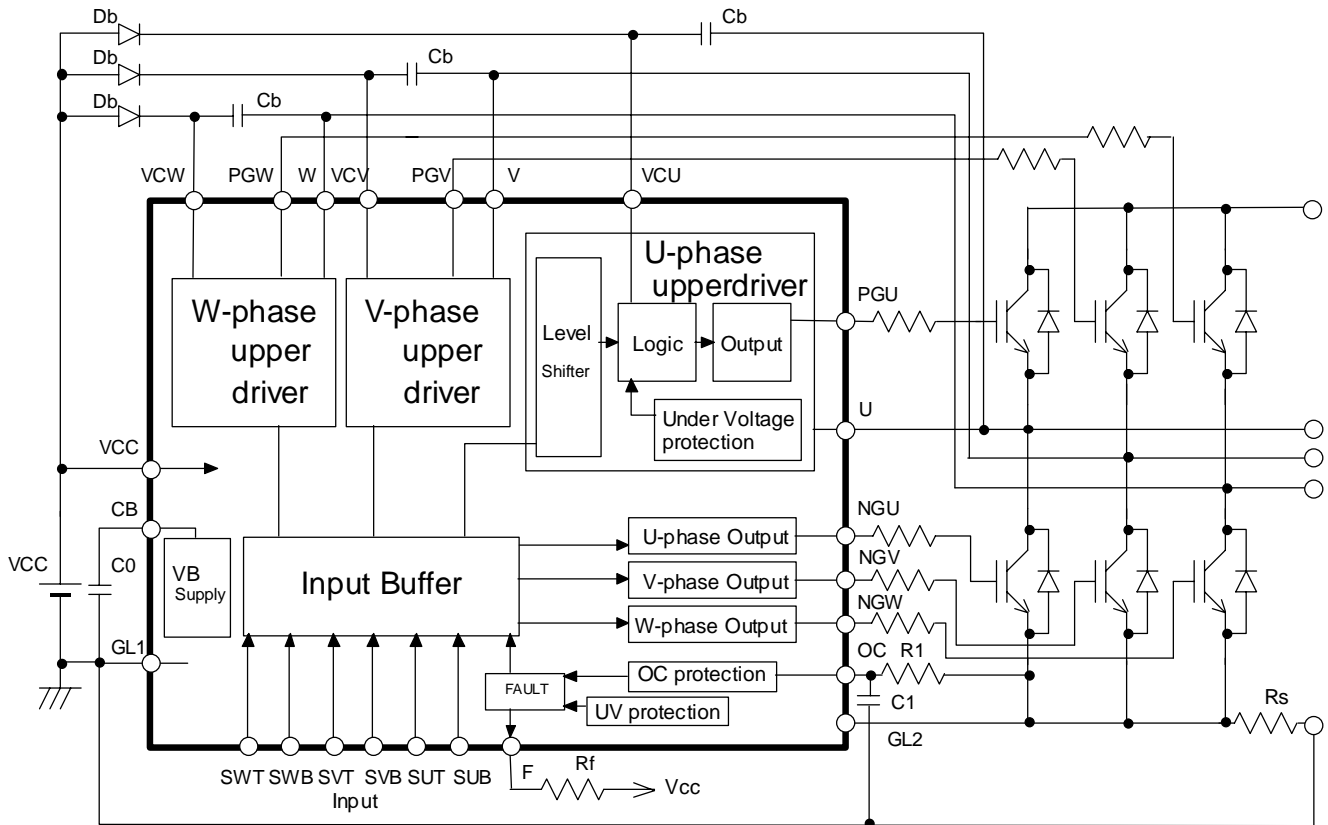
Package



Features

- It can be controlled by PWM with 6 inputs from an external microprocessor.
- 6 logic inputs are compatible with 5V CMOS.

Block Diagram



Block diagram

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1. General

This specification shall be applied to the following semiconductor integrated circuits.

- 1) Type : ECN3054F
- 2) Application : 3-phase Brushless DC Motor, 3-phase Induction Motor
- 3) Structure: Monolithic IC
- 4) Package : FP-28DJ (JEDEC)

2. Maximum Allowable Ratings (Ta=25 °C)

No.	ITEMS	SYMBOLS	VALUES	UNIT	CONDITIONS
1	Output Device Breakdown Voltage	Vbv	620	V	Between VCU,V,W & GL1
2	GL2 terminal voltage	Vgl2	-5~Vcc	V	Vcc=18Vmax at GL2=-5V
3	U,V,W terminal Voltage	Vu,v,w	-5~600	V	
4	Supply voltage	Vcc	20	V	
5	Input voltage	Vin	-0.5~Vcc+0.5	V	
6	Operating Junction Temperature	Tjop	-20~125	°C	
7	Storage Temperature	Tstg	-40~150	°C	

Note 1 : Thermal resistance Rja

PACKAGE	FP-28DJ	UNIT
Single	121	°C/W
Mounted	84	°C/W
PCB size *	120x21x1.6 (30%)	(mm)

* This figure varies depending on the mounting condition.

3. Recommended Operating Conditions

No.	ITEMS	SYMBOLS	VALUES TOL.	UNIT	CONDITIONS
1	U,V,W terminal Voltage	Vu,v,w	-3 ~ 400	V	
2	Supply Voltage	Vcc	13.5 ~ 16.5	V	

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4. Electrical Characteristics

Unless otherwise noted, Ta=25°C, Vu,v,w to GL1=374V, Vcc=15V. (suffix T=top, B=bottom arm)

No	ITEMS	SYMBOLS	MIN	TYP	MAX	UNIT	CONDITIONS
1	Stand-by current	Is1	-	6.5	10	mA	Vin=H or L , Between Vcc-GL1
		Is2	-	15	30	μA	Between VCU-U,VCV-V,VCW-W 15V, Vin=H or L
2	Input Voltage (Output is L)	VIH	3.5	-	-	V	Input=H or L
	Input Voltage (Output is H)	VIL	-	-	1.5	V	
3	Output Source Current	Io+	0.2	0.25	-	A	VCU-PGU,VCV-PGV,VCW-PGW=15V, Vcc-NGU,V,W =15V PW<10μs
4	Output Sink Current	Io-	0.4	0.5	-	A	PGU-U,PGV-V, PGW-W =15V, NGU,V,W -GL2=15V PW<10μs
5	High level Output Voltage	VOH	-	-	100	mV	VCU,V,W-PGU,V,W & Vcc-NGU,V,W Vin=0V, Io=0A
6	Low level Output Voltage	VOL	-	-	100	mV	PGU,V,W-U,V,W & NGU,V,W-GL2 Vin=5V,Io=0A
7	Leakage Current at HV terminal	IL	-	-	50	μA	VCU,V,W=U,V,W=600V
8	Input Current	IIL	-200	-	-	μA	Vin=0V Internal Pull up R=200kΩ
9	Input Current	IIH	-120	-	-	μA	Vin=5V Internal Pull up R=200kΩ
10	Vcc Under Voltage	Negative Going	Vvub	9.5	10.5	11.6	V
		Reset Hysteresis	Vrhb	0.1	0.4	0.9	V
11	Vcu,v,w Under Voltage	Negative Going	Vvut	8.9	10.5	12.1	V
		Reset Hysteresis	Vrht	0.1	0.4	0.9	V
12	OC Input Positive Going threshold	Voc	0.44	0.49	0.54	V	
13	Fault Output On Resistance	Ronf	-	300	400	Ω	F-GL1=0.5V
14	Turn On Delay Time	ton	-	0.8	1.5	μs	CL=1000pF RL=0Ω
15	Turn Off Delay Time	toff	-	0.5	1.2	μs	CL=1000pF RL=0Ω
16	OC Output Shutdown Delay	toc	-	0.7	1.7	μs	CL=1000pF RL=0Ω
17	Fault Output Delay	tflt	-	0.6	1.6	μs	CL=1000pF RL=0Ω
18	Fault Reset Delay Time	tflrs	6.5	10	20	μs	CL=1000pF RL=0Ω
19	Fault output terminal voltage	Vflt	-0.5	-	Vcc+0.5	V	
20	Fault output sink current	Iflt	4	-	-	mA	Vcc=15V,F-GL=2V
21	VB output Voltage	VB	6.8	7.5	8.2	V	Output current=0mA
22	VB output current	IB	15	20	-	mA	DeltaVload=0.2V

Note 1: Vvub, Vrhb, Vvut and Vrht are defined and shown in Fig. 1

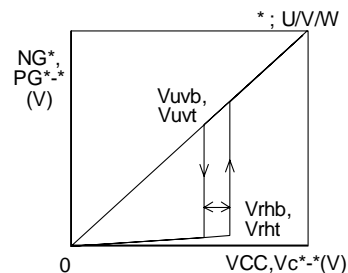


Fig 1. Negative going and reset voltage and hysteresis for the top and bottom arm under voltage circuit

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5. Truth Table

INPUT		OC Input	U phase		V phase		W phase		
			Top arm	Bot.arm	Top arm	Bot.arm	Top arm	Bot.arm	
SUT	L	L	ON	-	-	-	-	-	
	H		OFF	-	-	-	-	-	
SUB	L		-	ON	-	-	-	-	
	H		-	OFF				-	
SVT	L		-	-	ON			-	
	H		-	-	OFF			-	
SVB	L		-	-	-	ON		-	
	H		-	-	-	OFF		-	
SWT	L		-	-	-	-	ON	-	
	H		-	-	-	-	OFF	-	
SWB	L		-	-	-	-	-	ON	
	H		-	-	-	-	-	OFF	
-	-		H	OFF	OFF	OFF	OFF	OFF	OFF
SUT,SUB	L		L	OFF	OFF	-	-	-	-
SVT,SVB	L		L	-	-	OFF	OFF	-	-
SWT,SWB	L		L	-	-	-	-	OFF	OFF

Note 1: Fault output level is referenced Low when over current or under voltage for Vcc is detected.

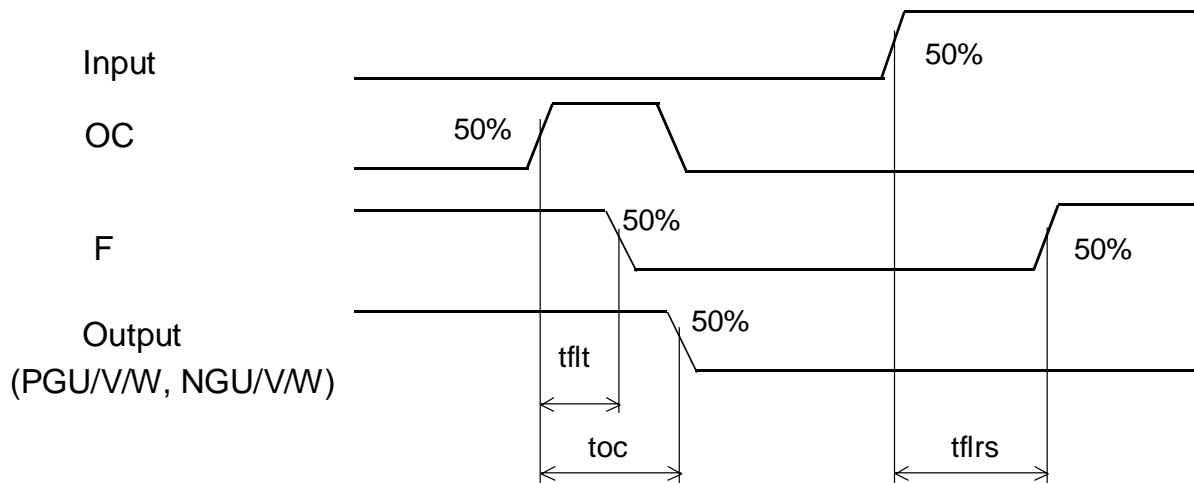
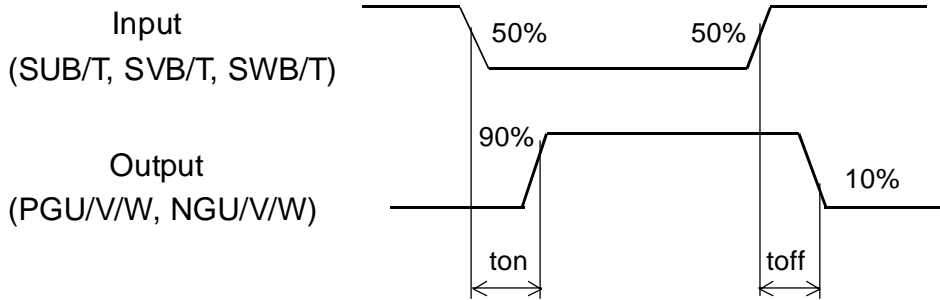
Note 2: Over current protection works when the voltage drop of the external sensing resistor exceeds the threshold voltage Voc. In this case all six outputs are turned off and Fault output level becomes low.

Reset after detection is done by feeding high signal to all six inputs or re-supplying Vcc voltage.

Note 3: The output signal for Fault is reset by feeding high signal to all six inputs.

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6. Definition of switching delay



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7. Standard Application

No.	ITEMS	SYMBOLS	VALUES TOL.	UNIT	CONDITIONS
1	PWM Frequency	fpwm	1 ~ 20	kHz	
2	VB Smoothing Capacitor	Co	0.22 ± 20%	μF	Stress voltage:VB
3	Boot Strap Capacitor	Cb	3.3 ± 20%	μF	Stress voltage:Vcc
4	Boot Strap Diodes	Db	Hitachi DFG1C6 DFM1F6 or equivalent	-	600V/1.0A trr ≤ 0.1μs
5	Sensing Resistor	Rs	Note 1	Ω	
6	OC Filtering Resistor	R1	Note 2	Ω	
7	OC Filtering Capacitor	C1	Note 2	μF	
8	Load resistor for F terminal	Rf	5.6 ± 20%	kΩ	

Note 1. Over-current detection level is determined by the following equation

$$I_{oc} = V_{oc} / R_s \text{ (A)}$$

Note.2 This IC has filters of 0.4us for noise reduction.

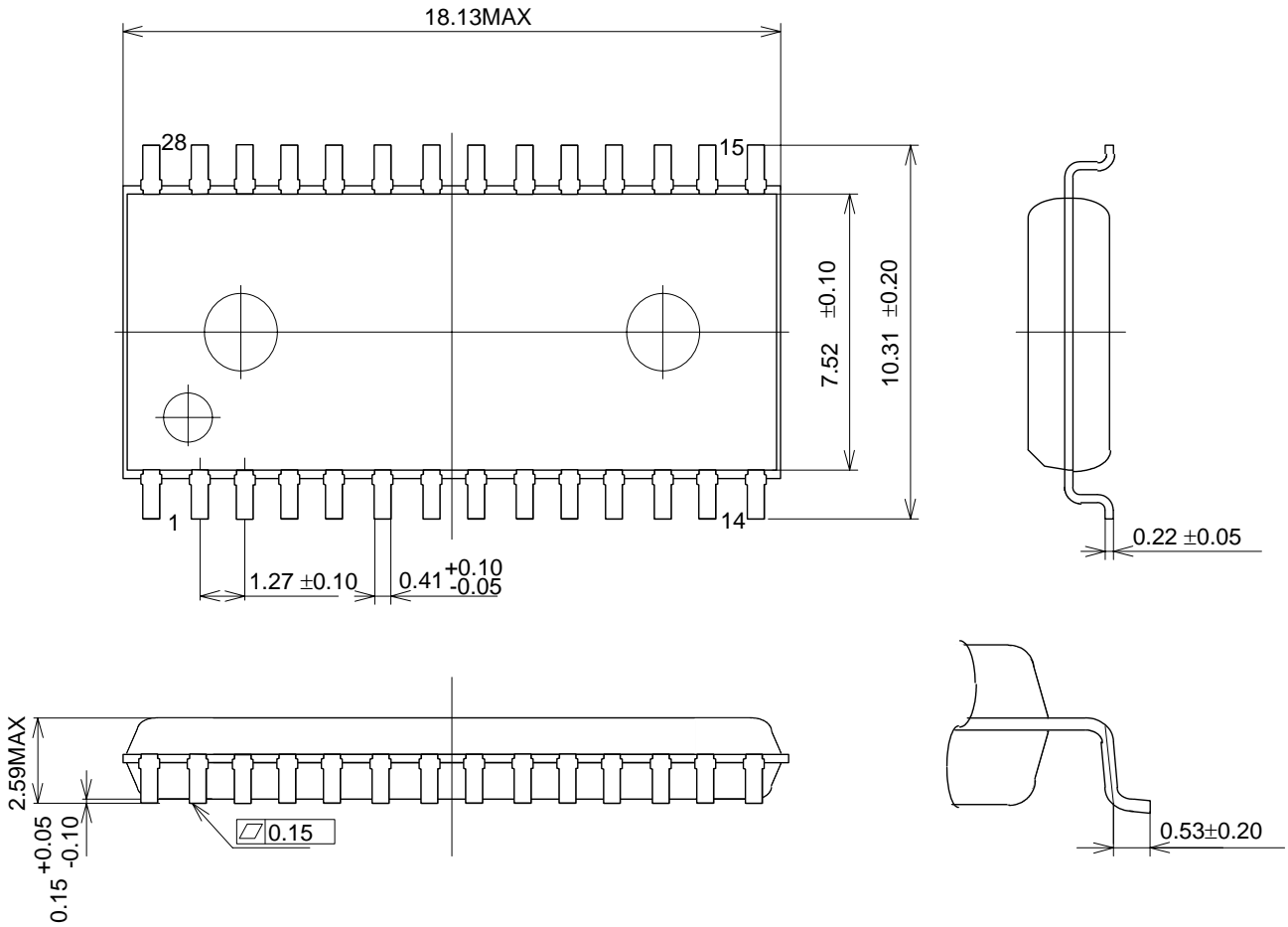
But appropriate R1, C1 should be added when noise can not be removed.

8. Pin Assignment

1	VCC	VCU	28
2	SUT	PGU	27
3	SVT	U	26
4	SWT	N.C	25
5	SUB	VCV	24
6	SVB	PGV	23
7	SWB	V	22
8	F	N.C	21
9	OC	VCW	20
10	CB	PGW	19
11	N.C	W	18
12	GL1	N.C	17
13	GL2	NGU	16
14	NGW	NGV	15

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9. Outline Drawing



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