3-Phase Motor Driver IC

ECN30620 Product Specification   Rev. 2

1. Product Description

1.1 Features

(1) Maximum Ratings: 600VDC/2.0A (condition: Tj=25℃), suitable for the system from 200VAC to 240VAC

(2) PWM control of top and bottom arm IGBTs is possible with six control signals

(3) Six IGBTs, six FWDs (Free-Wheeling Diodes), drivers for IGBTs, protection circuits, etc. integrated into a single chip, resulting in space reduction

(4) Drives a motor using a high voltage DC power supply and a low voltage DC power supply (15V)

(5) Motor under free run condition detected by built-in back EMF detection circuit

(6) Lineup of two packages, DIP26, SOP26 and DIP26N ensuring insulation distance for high voltage pins

1.2 Functions

(1) Back EMF detection function (Three-phase)

(2) Prevention function against simultaneous ON of top and bottom arm IGBTs

(3) Charge pump circuit (Built-in clock circuit and high voltage diodes)

(4) Current limit function (detects at 0.5V)

(5) Over-current protection function (detects at 1.0V, selectable reset method)

(6) Over temperature protection function

(7) Fault function

(8) VCC low-voltage detection function

(9) 5V power supply circuit, 7.5V power supply circuit

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1.3 Block Diagram
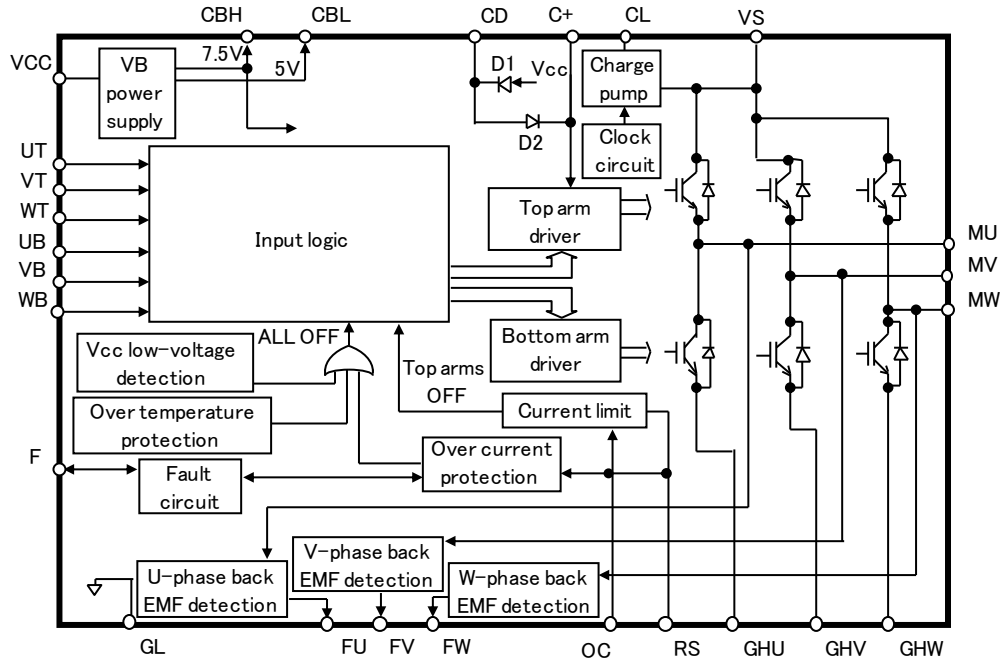
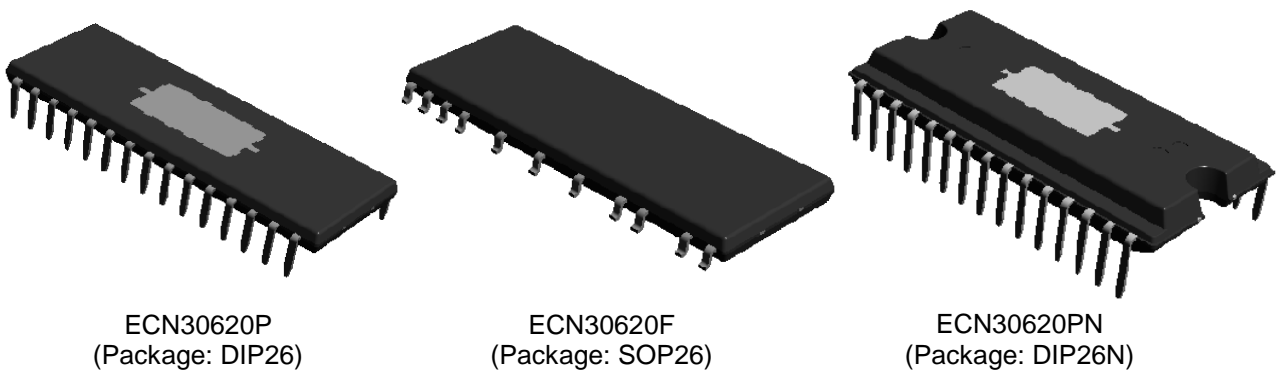FIGURE 1.3.1 shows block diagram.

FIGURE 1.3.1 Block Diagram

1.4 Packages

ECN30620P
(Package: DIP26)

ECN30620F
(Package: SOP26)

ECN30620PN
(Package: DIP26N)

FIGURE 1.4.1 Packages of ECN30620

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2. Specification

2.1 Maximum ratings

TABLE 2.1.1 Maximum ratings   Condition: Ta=25℃

No.	Item		Symbol	Pin	Rating	Unit	Condition
1	Output device breakdown voltage		VSM	VS, CL, CD MU, MV, MW	600	V	
2	VCC power supply voltage		VCC	VCC	18	V	
3	Voltage between C+ and VS		VCPM	C+, VS	18	V	
4	Input voltage 1		VIN1	UT, VT, WT, UB, VB, WB, RS	−0.5 to VBH+0.5	V	
5	Input voltage 2		VIN2	OC	−0.5 to Vcc+0.5	V	
6	Output current	Pulse	IP	MU, MV, MW	2.0	A	Note 1
7		DC	IDC		1.0		
8	Fault output voltage		Vflt	F	−0.5 to Vcc+0.5	V	
9	FU, FV, FW output voltage		VFU, VFV, VFW	FU, FV, FW	−0.5 to VBH+0.5	V	
10	VB supply output current		IBMAX	CBL, CBH	50	mA	Note 2
11	Junction operating temperature		Tjop	—	−40 to +135	℃	Note 3
12	Storage temperature		Tstg	—	−40 to +150	℃	

Note 1: Output IGBTs can handle this peak current.
Note 2: Total value of CBL and CBH.
Note 3: Thermal resistance
  Between junction and case (tab): Rjc = 3℃/W (Reference value)

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2.2 Electrical Characteristics

TABLE 2.2.1 Electrical Characteristics (1/2) Suffix (T: Top arm, B: Bottom arm) Condition: Ta=25°C

No.	Item		Symbol	Pin	Min.	Typ.	Max.	Unit	Condition
1	Standby current		ISH	VS	−	0.1	0.4	mA	UT,VT,WT,UB,VB,WB=0V
2			ICC	VCC	−	5	10	mA	VS=325V, VCC=15V, IBL, IBH=0A
3	IGBT collector-emitter		VONT	MU,MV,	−	2.0	3.0	V	I=0.35A, VCC=15V
4	saturation voltage		VONB	MW	−	2.0	3.0	V	
5	Free-wheeling diode		VFDT	MU,MV,	−	1.6	2.8	V	I=0.35A
6	forward voltage		VFDB	MW	−	1.6	2.8	V	
7	Output delay time	Turn ON	TdONT	MU, MV, MW	−	0.7	1.1	μs	VS=325V, VCC=15V I=0.35A, Resistance load
8			TdONB		−	0.7	1.1	μs	
9		Turn OFF	TdOFFT		−	0.7	1.1	μs	
10			TdOFFB		−	0.7	1.1	μs	
11	Minimum pulse width		TMINB	MU,MV, MW	0.5	−	−	μs	VCC=15V Note 1
12	Current limit	Reference voltage	Vref1	RS	0.45	0.50	0.55	V	VCC=15V
13		Delay time	Tref1		−	2.0	4.5	μs	
14	Over-current protection	Reference voltage	Vref2	RS,F	0.9	1.0	1.1	V	VCC=15V
15		Delay time	Tref2		−	1.7	3.0	μs	
16		Recovery time	Trs		−	1.0	2.0	ms	VCC=15V, CF=1000pF, RF=820kΩ, OC=VCC, Connect RF to CBL.
17	RS input current		IILRS	RS	−100	−	−	μA	VCC=15V, RS=0V Note 2
18	Over temperature protection	Operating temperature	TSDON	MU, MV, MW	135	160	185	°C	VCC=15V
19		Hysteresis	TSDHYS		−	25	−	°C	
20	VCC low-voltage detection	Operating voltage	LVSDON	VCC, MU,MV, MW	11.0	12.0	12.9	V	
21		Recovery voltage	LVSDOFF		11.1	12.5	13.0	V	
22	UT,VT,WT, UB,VB,WB inputs	Voltage	VIH	UT,VT,WT, UB,VB,WB	3.0	−	−	V	VCC=15V
23			VIL		−	−	1.0	V	
24		Current	IIH		−	−	100	μA	Input=5V VCC=15V Pull-down resistor Note 3
25			IIL		−10	−	−	μA	Input =0V VCC=15V
26	VBL supply output	Voltage	VBL	CBL	4.5	5.0	5.5	V	VCC=15V, IBL=0A
27		Current	IBL		−	−	45	mA	VCC=15V Note 4
28	VBH supply output	Voltage	VBH	CBH	6.8	7.5	8.2	V	VCC=15V, IBH=0A
29		Current	IBH		−	−	45	mA	VCC=15V Note 4
30	Fault reset input time		Tflrs	F	−	15	30	μs	VCC=15V, OC=GL or CBH
31	F output resistance		RONF	F	−	0.9	1.8	kΩ	Note 5
32	FU, FV, FW output resistance		RONFU, RONFV, RONFW	FU,FV,FW	−	0.8	1.6	kΩ	Note 6
33	Charge pump diode forward voltage		VFDCP	VCC, CD,C+	−	0.8	1.4	V	I=1mA
34	Back EMF detection level		VIHE	MU,MV, MW	4	−	−	V	VCC=15V, UT,VT,WT,UB,VB,WB=0V
35			VILE		−	−	1	V	

Note 1: The minimum pulse width to be able to turn on and off top and bottom arms.
Note 2: Internal pull-up resistor is typically 200kΩ. The equivalent circuit is shown in FIGURE 2.2.1.
Note 3: Internal pull-down resistor is typically 200kΩ. The equivalent circuit is shown in FIGURE 2.2.2.
Note 4: The total value of IBL and IBH must be the IBMAX maximum rating or lower.
Note 5: The equivalent circuit is shown in 2.2.3.
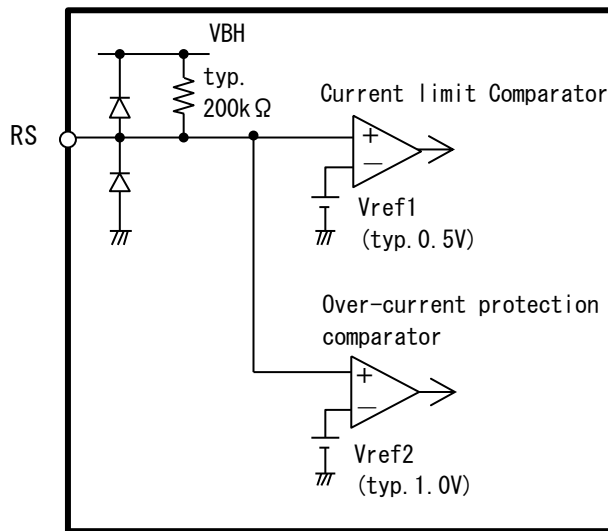Note 6: The equivalent circuit is shown in 2.2.4.

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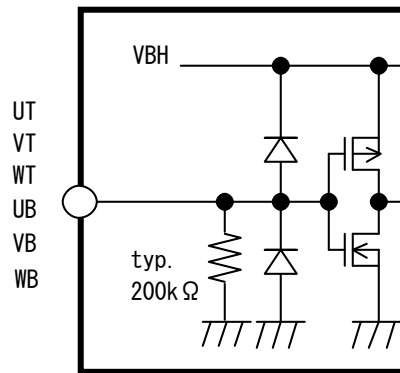**FIGURE 2.2.1 Equivalent Circuit around RS Pin**

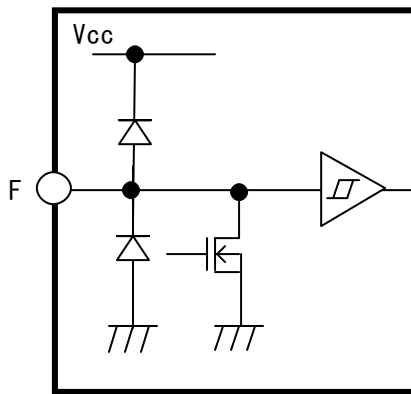**FIGURE 2.2.2 Equivalent Circuit around UT, VT, WT, UB, VB, WB Pins**
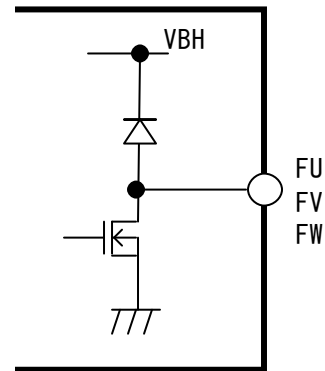
FIGURE 2.2.3 Equivalent Circuit around F Pin

FIGURE 2.2.4 Equivalent Circuit around FU, FV, FW Pins

2.3 Operating Condition

TABLE 2.3.1 Operating Condition

No.	Item	Symbol	Pin	Min.	Typ.	Max.	Unit	Condition
1	Supply voltage	VSop	VS	50	325	450	V	
2		VCCop	VCC	13.5	15.0	16.5	V	
3	GH voltage	Vgh	GHU, GHV, GHW	−1.2	—	1.2	V	Based on GL

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2.4 Functions and Operations
2.4.1 Truth Table

TABLE 2.4.1.1 Truth Table

Input UT,VT,WT UB,VB,WB	IGBT operation
L	OFF
H Note 1	ON

Note 1: When the top input and bottom input in the same phase are "H" simultaneously, the top and bottom arm IGBTs in this phase are both off.

2.4.2 Current Limit Function
When the voltage at the RS pin exceeds the current limit reference voltage (Vref1, typ. 0.5V), the top arm IGBTs are all turned off. When each of the input UT, VT, and WT is "L", this limit operation is individually reset in each phase. "L" is not outputted to the F pin in this function operation.

2.4.3 Over-current Protection
When the voltage at the RS pin exceeds the over-current protection reference voltage (Vref2, typ. 1.0V), the F output is "L", and the top and bottom arm IGBTs are all turned off. When this function is not used, connect the F pin to the VCC pin. Section 2.4.4 describes how to reset this protection operation.

2.4.4 OC Setting Method
The settings of the OC pin depends on whether to use the current limit function or not and how to reset the over-current protection operation. Connect the OC pin to the GL pin, CBH pin, or VCC pin based on your preference (see TABLE 2.4.4.1). FIGUREs 2.4.4.1, 2.4.4.2, and 2.4.4.3 show the timing charts of the protection function in each setting.

TABLE 2.4.4.1 OC Setting Method

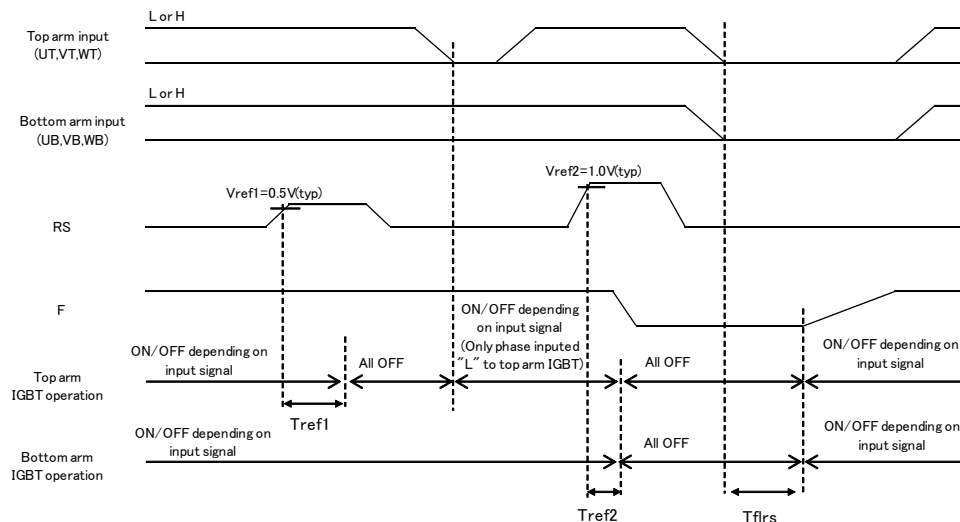| Connected pin	Current Limit Function	Method for resetting over-current protection operation	Timing chart
GL	Enable	Holding All inputs "L" (Reset after holding "L" for more than the Fault reset input time (Tflrs))	FIG.2.4.4.1
CBH	Disable		FIG.2.4.4.2
VCC	Disable	Automatically (Reset after the recovery time (Trs) passes)	FIG.2.4.4.3

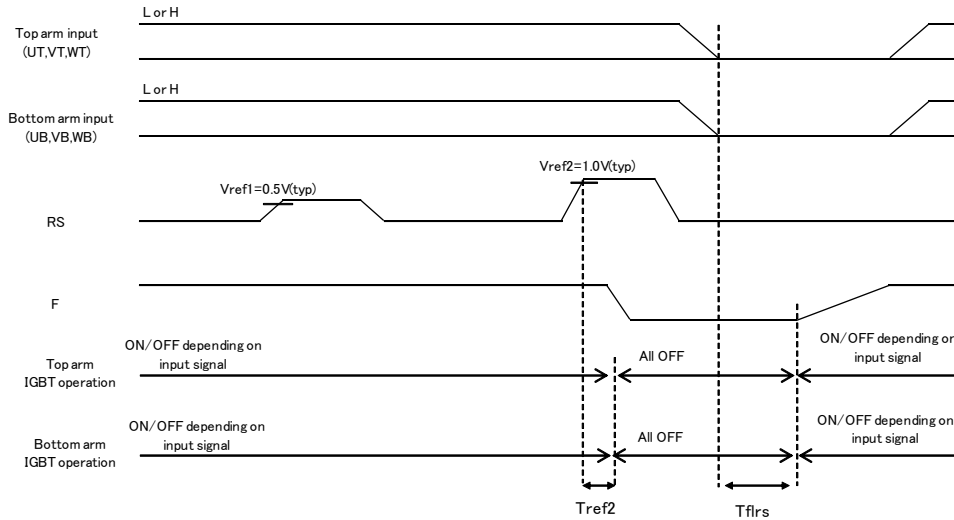**FIGURE 2.4.4.1 Timing Chart in Case of OC Connected to GL**

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FIGURE 2.4.4.2 Timing Chart in Case of OC Connected to CBH
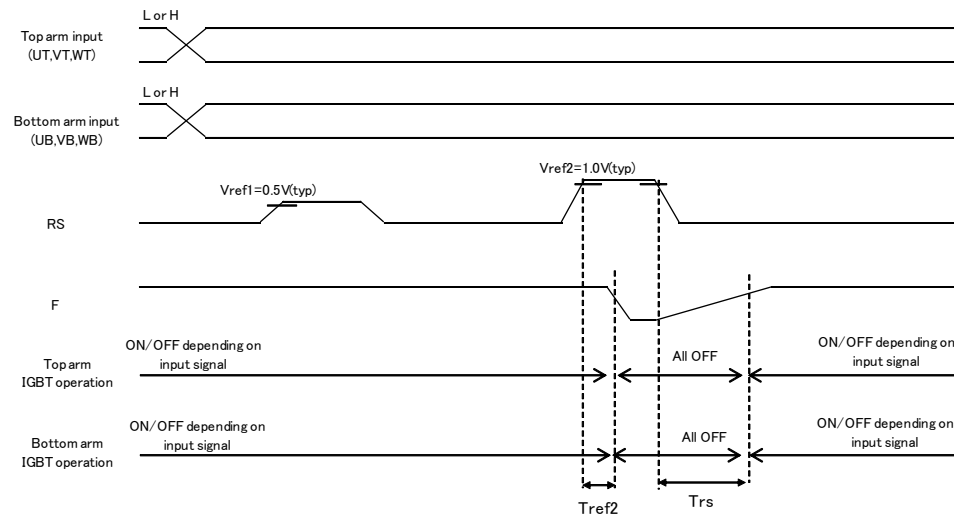

FIGURE 2.4.4.3 Timing Chart in Case of OC Connected to VCC

2.4.5 VCC Low-Voltage Detection

When the VCC voltage drops below the operating voltage of the VCC low-voltage detection (LVSDON), all IGBTs (top and bottom arms) are turned off. When the VCC voltage goes up above the recovery voltage of the VCC low-voltage detection (LVSDOFF), the IC returns to the state in which the IGBTs operate depending on input signals. "L" is not outputted to the F pin in this function operation.
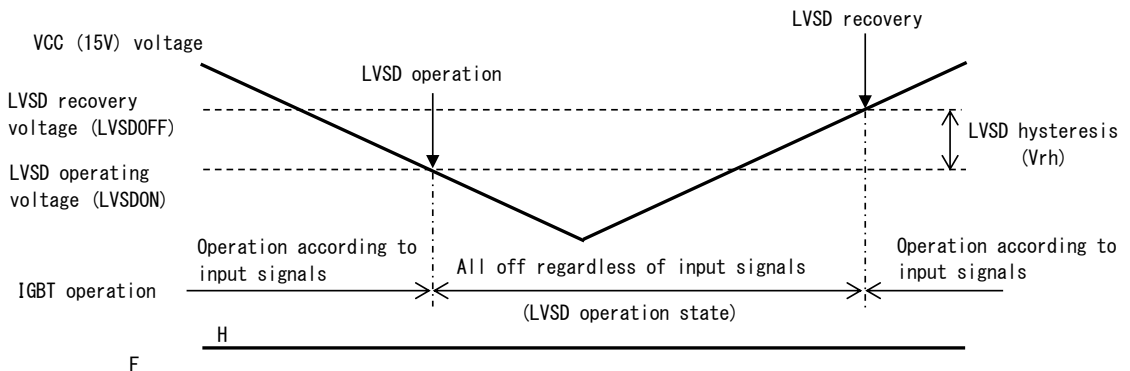

FIGURE 2.4.5.1 Timing Chart for VCC Low-voltage Detection (LVSD Operation)

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2.4.6 Over Temperature Protection

When the IC temperature exceeds the operating temperature of over temperature protection (TSDON), all IGBTs (top and bottom arms) are turned off. When the IC temperature goes down the hysteresis (TSDHYS) from the operating temperature of over temperature protection (TSDON), the IC returns to the state in which the IGBTs operate depending on input signals. "L" is not outputted to the F pin in this function operation.
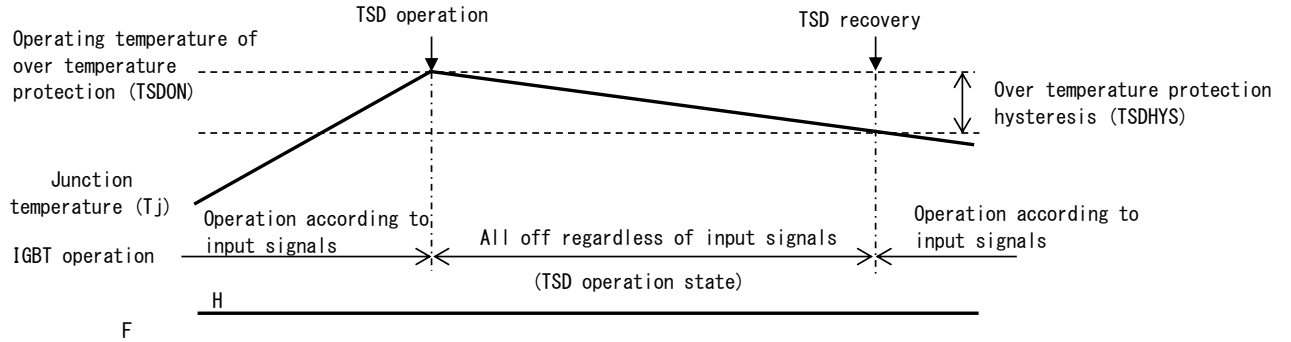

FIGURE 2.4.6.1 Timing Chart for Over Temperature Protection Operation

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3. Standard Applications

3.1 External Components

TABLE 3.1.1 External Components

| Component	Standard value	Usage	Remark
CH0, CL0	1.0µF±10%, 25V	Smooths the internal power supply (VB)	
CV1	1µF±10%, 25V	Smooths Vcc power supply	Note 1
CV2	33nF±10%, 630V	Smooths Vs power supply	Note 1
C1, C2	0.22µF±10%, 25V	For charge pump	
Rs	1Ω±1%, 1W	Sets current limit function and over-current protection	Note 2
RFU, RFV, RFW	10kΩ±5%	For pull up	
CF	0.01µF±10%, 25V	Removes output noise of Fault signal	In the case of OC = GL or CBH
RF	10kΩ±10%	For pull up	
CF	1000pF±10%, 25V	Sets over-current protection reset time	In the case of OC = VCC
RF	820kΩ±10%		
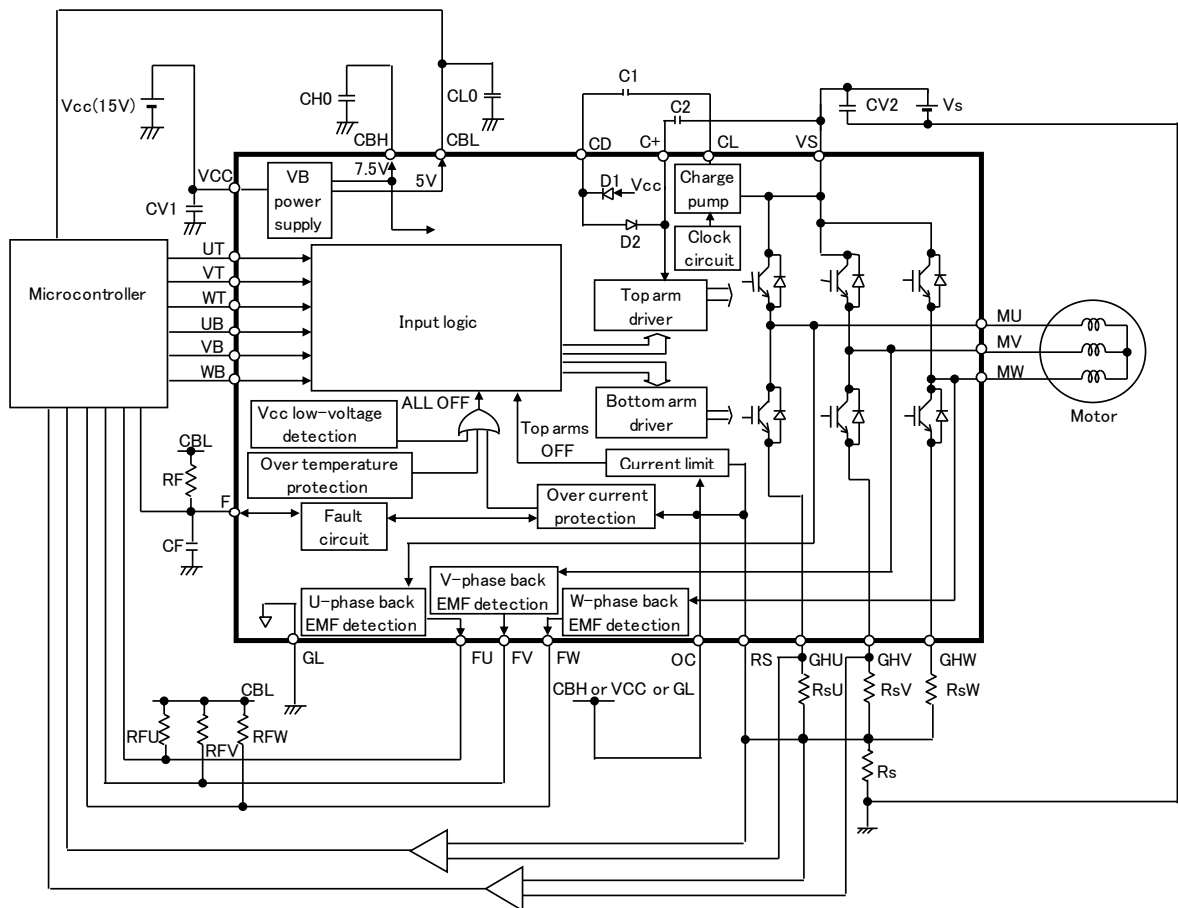
FIGURE 3.1.1 Block Diagram (ECN30620 is shown inside the bold line.)

Note 1. Caution for smoothing capacitor

As necessary, increase the capacitance of a capacitor or connect a zener diode in consideration of noise immunity.

Note 2. Caution for external components setting of charge pump circuit

If the capacitance is small, voltage between C+ and VS decreases by consumption current inside IC from C+ pin. If the C+ - VS voltage decreases, gate voltage for top arm IGBT lowers.

The low gate voltage may increase Tj by top arm IGBT ON resistance increase, or lower top arm IGBT saturation current. These may cause IC deterioration or malfunctioning.

Voltage of the capacitor is almost same as Vcc voltage. The withstanding voltage of the capacitor must be more than Vcc voltage. When standard components are not applied, be careful about it.

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Note 3. Caution for Rs resistance setting

The current limit set value (IO_1) can be calculated as follows.

$$IO\_1 = Vref1/Rs$$

Vref1:Current limit reference voltage

Rs   :Shunt resistance value

The over-current protection set value (IO_2) can be calculated as follows.

$$IO\_2 = Vref2/Rs$$

Vref2:Over current protection reference voltage

Rs   :Shunt resistance value

Delay time to turn output IGBT off (Tref1, Tref2) and variability of Vref1, Vref2, Rs need to be considered. Observe IC output current (motor current), and confirm design margin.

When shunt resistance value is set, GHU, GHV, and GHW voltages are not allowed to exceed the range of Vgh.

3.2 Input Pins (UT, VT, WT, UB, VB, WB)

In some applications, input pins may be sensitive to noise due to high impedance. If noise is detected at an input pin, the following resistor and/or capacitor should be added.

・Resistor : 5.6kΩ ± 5% pull-down resistor between the GL pin and input pins

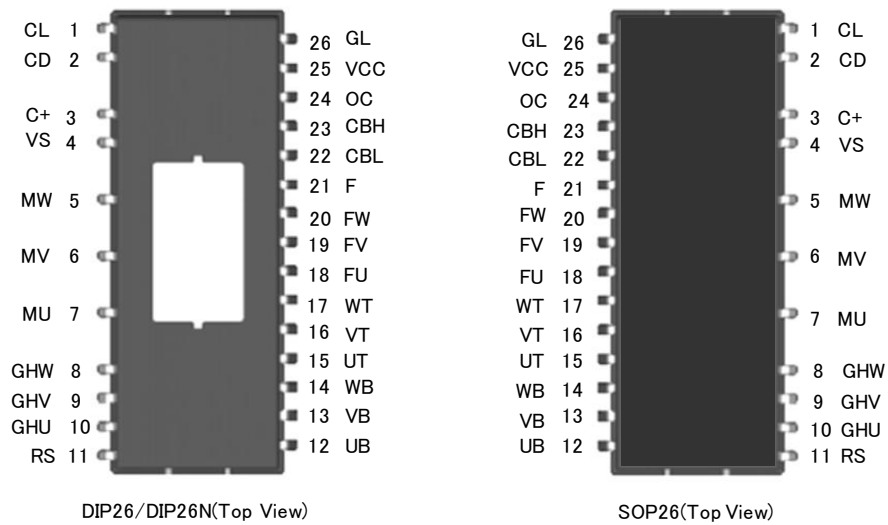・Capacitor : 470pF ± 20% ceramic capacitor close to the input pin

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4. Pin Locations

DIP26/DIP26N(Top View)   SOP26(Top View)

FIGURE 4.1 Pin Locations

5. Explanations of Pins
TABLE 5.1 Explanations of Pins

Pin No.	Symbol	Explanation	Remark
1	CL	For the charge pump circuit	Note 1
2	CD	For the charge pump circuit	Note 1
3	C+	For the charge pump circuit	Note 1
4	VS	High voltage power supply	Note 1
5	MW	W phase output	Note 1
6	MV	V phase output	Note 1
7	MU	U phase output	Note 1
8	GHW	Emitters of W-phase bottom arm IGBT and anode of W-phase bottom arm FWD	
9	GHV	Emitters of V-phase bottom arm IGBT and anode of V-phase bottom arm FWD	
10	GHU	Emitters of U-phase bottom arm IGBT and anode of U-phase bottom arm FWD	
11	RS	Input for current limit and over-current protection	
12	UB	Input control signal for U-phase bottom arm	
13	VB	Input control signal for V-phase bottom arm	
14	WB	Input control signal for W-phase bottom arm	
15	UT	Input control signal for U-phase top arm	
16	VT	Input control signal for V-phase top arm	
17	WT	Input control signal for W-phase top arm	
18	FU	U-phase back EMF signal output	
19	FV	V-phase back EMF signal output	
20	FW	W-phase back EMF signal output	
21	F	Fault signal output or setting over-current protection reset time	
22	CBL	VBL power supply output (5V)	
23	CBH	VBH power supply output (7.5V)	
24	OC	Setting for current limit function (available / not available) and over-current protection reset method	
25	VCC	15V power supply	
26	GL	Ground	

Note 1. High voltage pin. The voltage between CD and CL and between C+ and VS are low. Therefore, the distances between these pins are the same as that between the low voltage pins.

Note 2. The tab potential is the same as that of the GL pin. Set the tab potential to open or the same as that of GND. If the tab is mounted on the external cabinet of the motor for heat radiation purposes, the IC will not be able to withstand an isolation withstand voltage test in which a high voltage is applied between the external cabinet and the GND. Please insert an insulation sheet or something similar between the IC tab and the external cabinet.

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6. Inspection
Hundred percent inspection shall be conducted on electric characteristics at room temperature. For the operating temperature and hysteresis of the over temperature protection, equivalent inspections are conducted at room temperature.

7. Precautions for use
　　7.1 Countermeasures against Electrostatic Discharge (ESD)
　　　　　(a) Customers need to take precautions to protect ICs from electrostatic discharge (ESD). The material of the container or any other device used to carry ICs should be free from ESD, which can be caused by vibration during transportation. Use of electrically conductive containers is recommended as an effective countermeasure.
　　　　　(b) Everything that touches ICs, such as the work platform, machine, measuring equipment, and test equipment, should be grounded.
　　　　　(c) Workers should be high-impedance grounded (100kΩ to 1MΩ) while working with ICs, to avoid damaging the ICs by ESD.
　　　　　(d) Friction with other materials, such as high polymers, should be avoided.
　　　　　(e) When carrying a PCB with a mounted IC, ensure that the electric potential is maintained at a constant level using the short-circuit terminals and that there is no vibration or friction.
　　　　　(f) The humidity at an assembly line where ICs are mounted on circuit boards should be kept around 45 to 75 percent using humidifiers or such. If the humidity cannot be controlled effectively, using ionized air blowers (ionizers) is effective.

　　7.2 Output Short-Circuit Protection
　　　　A short circuit (ex. load short) could damage this IC (the products of Hitachi Power Semiconductor Device, hereinafter called "HPSD's IC"). External protection is needed to prevent HPSD's IC breakdown.

　　7.3 Maximum ratings
　　　　Regardless of changes in external conditions during use HPSD's IC, the "maximum ratings" described in this document should never be exceeded when designing electronic circuits that employ HPSD's IC. If maximum ratings are exceeded, HPSD's IC may be damaged or destroyed. In no event shall Hitachi Power Semiconductor Device (hereinafter called "HPSD") be liable for any failure in HPSD's IC or any secondary damage resulting from use at a value exceeding the maximum ratings.

　　7.4 Derating Design
　　　　Continuous high-load operation (high temperatures, high voltages, large currents) should be avoided and derating design should be applied, even within the ranges of the maximum ratings, to ensure reliability.

　　7.5 Safe Design
　　　　The HPSD's IC may fail due to accidents or unexpected surge voltages. Accordingly, adopt safe design features, such as redundancy and measures to prevent misuse, in order to avoid extensive damage in the event of a failure.

　　7.6 Application
　　　　If HPSD's IC is applied to the following uses where high reliability is required, obtain the document of permission from HPSD in advance.
　　　　・Automobile, Train, Vessel, etc.
　　　Do not apply HPSD's IC to the following uses where extremely high reliability is required.
　　　　・Nuclear power control system, Aerospace instrument, Life-support-related medical equipment, etc.

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7.7 Soldering
  (1) DIP26, DIP26N soldering condition
   The peak temperature of flow soldering* must be less than 260°C, and the dip time must be
   less than 10 seconds. High stress by mounting, such as long time thermal stress by preheating,
   mechanical stress, etc, can lead to degradation or destruction. Make sure that your mounting
   method does not cause problem as a system.

   ∗ Flow soldering: Only pins enter a solder bath, while the resin or tab does not.

  (2) SOP26 soldering condition
   This power semiconductor product is lead-free. The recommended reflow soldering condition is shown
   in FIGURE 7.7.1.
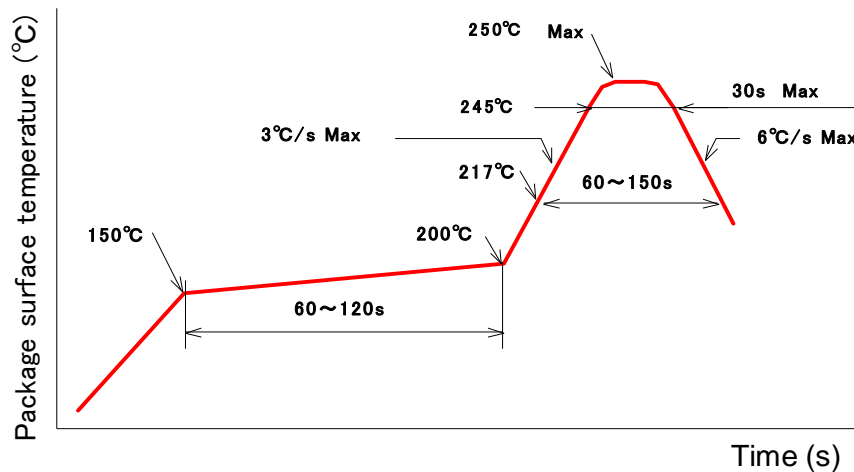
FIGURE 7.7.1 Recommended Conditions for Infrared Reflow or Air Reflow

  (3) Reliability of Solder Connection
   The reliability of solder connection depends on soldering condition, materials of circuit boards, footprint,
   etc. Test it sufficiently by heat cycle test, heat shock test, and so on after mounting ICs on circuit boards.

7.8 Others
   See "Instructions for Use of Hitachi High-Voltage Monolithic ICs" for other precautions and instructions on
   how to deal with these kinds of products.

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8. Usage

(1) HPSD warrants that the HPSD products have the specified performance according to the respective specifications at the time of its sale. Testing and other quality control techniques of the HPSD products by HPSD are utilized to the extent HPSD needs to meet the specifications described in this document. Not every device of the HPSD products is specifically tested on all parameters, except those mandated by relevant laws and/or regulations.

(2) Following any claim regarding the failure of a product to meet the performance described in this document made within one month of product delivery, all the products in relevant lot(s) shall be re-tested and re-delivered. The HPSD products delivered more than one month before such a claim shall not be counted for such response.

(3) HPSD assumes no obligation nor makes any promise of compensation for any fault which should be found in a customer's goods incorporating the products in the market. If a product failure occurs for reasons obviously attributable to HPSD and a claim is made within six months of product delivery, HPSD shall offer free replacement or payment of compensation. The maximum compensation shall be the amount paid for the products, and HPSD shall not assume responsibility for any other compensation.

(4) HPSD reserves the right to make changes in this document and to discontinue mass production of the relevant products without notice. Customers are advised to confirm specification of the product of inquiry before purchasing of the products that the customer desired. Customers are further advised to confirm before purchasing of such above products that the product of inquiry is the latest version and that the relevant product is in mass production status if the purchasing of the products by the customer is suspended for one year or more.

(5) When you dispose of HPSD products and/or packing materials, comply with the laws and regulations of each country and/or local government. Conduct careful preliminary studies about environmental laws applying to your products such as RoHS, REACH. HPSD shall not assume responsibility for compensation due to contravention of laws and/or regulations.

(6) HPSD shall not be held liable in any way for damages and infringement of patent rights, copyright or other intellectual property rights arising from or related to the use of the information, products, and circuits in this document.

(7) No license is granted by this document of any patents, copyright or other intellectual property rights of any third party or of HPSD.

(8) This document may not be reprinted, reproduced or duplicated, in any form, in whole or in part without the express written permission of HPSD.

(9) You shall not use the HPSD products (technologies) described in this document and any other products (technologies) manufactured or developed by using them (hereinafter called "END Products") or supply the HPSD products (technologies) and END Products for the purpose of disturbing international peace and safety, including (ⅰ) the design, development, production, stockpiling or any use of weapons of mass destruction such as nuclear, chemical or biological weapons or missiles, (ⅱ) the other military activities, or (ⅲ) any use supporting these activities. You shall not sell, export, dispose of, license, rent, transfer, disclose or otherwise provide the HPSD products (technologies) and END Products to any third party whether directly or indirectly with knowledge or reason to know that the third party or any other party will engage in the activities described above.
When exporting, re-export transshipping or otherwise transferring the HPSD products (technologies) and END Products, all necessary procedures are to be taken in accordance with Foreign Exchange and Foreign Trade Act (Foreign Exchange Act) of Japan, Export Administration Regulations (EAR) of US, and any other applicable export control laws and regulations promulgated and administered by the governments of the countries asserting jurisdictions over the parties or transaction.

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◆Appendix - Supplementary Data

See derating information below when designing with the ECN30620.

1. Safe Operation Area (SOA)
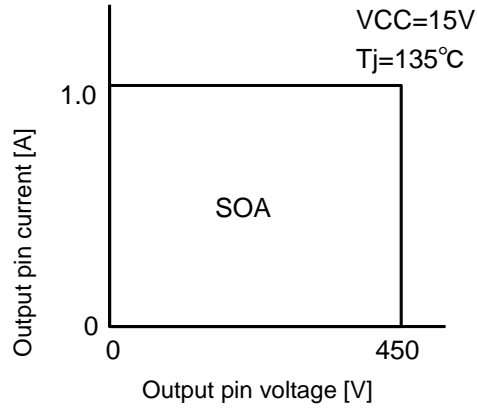The current and voltage at output pins must not be outside the SOA shown in FIGURE A.


FIGURE A: SOA

2. Shunt Resistor (Rs) Setting
Delay time to turn output IGBT off (Tref1, Tref2) and variability of Vref1, Vref2, Rs need to be considered, and the current must be below the derating curve of FIGURE A.

3. Derating design
(a) Temperature - It is recommended that junction operating temperature should be under $110°C$.
(b) Supply voltage - It is recomennded that Vs power supply voltage should be under 450V.
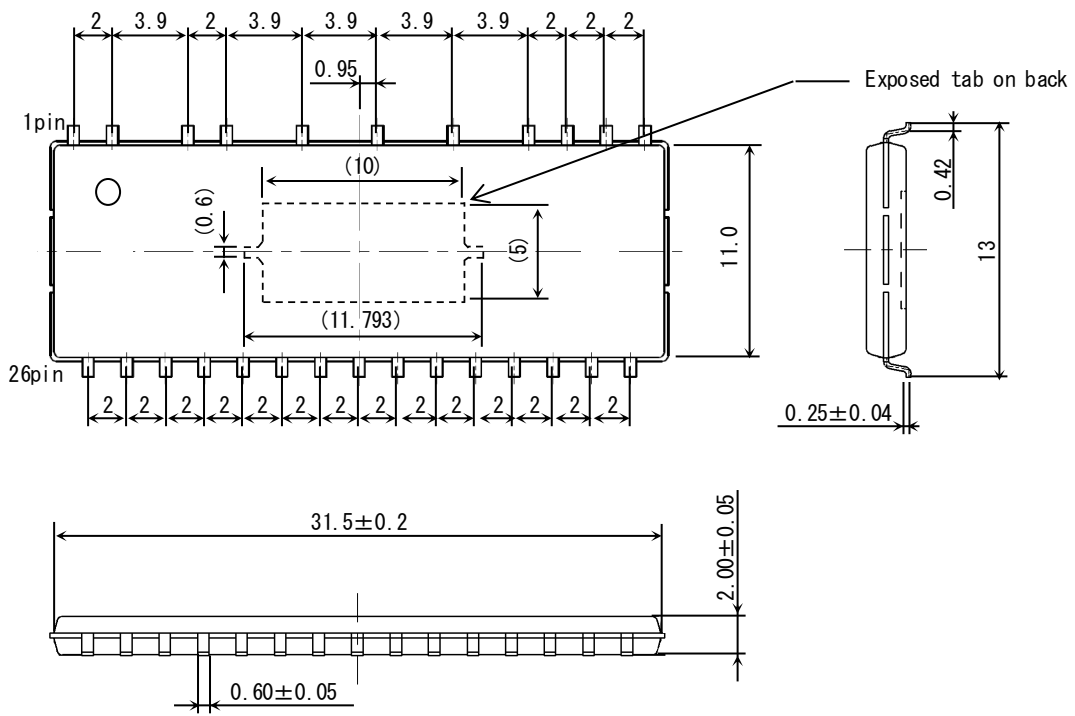
Junction operating temperature depends on various parameters such as power supply voltages, ambient temperature, load, heat dissipation routes. Test it sufficiently by using actual systems.

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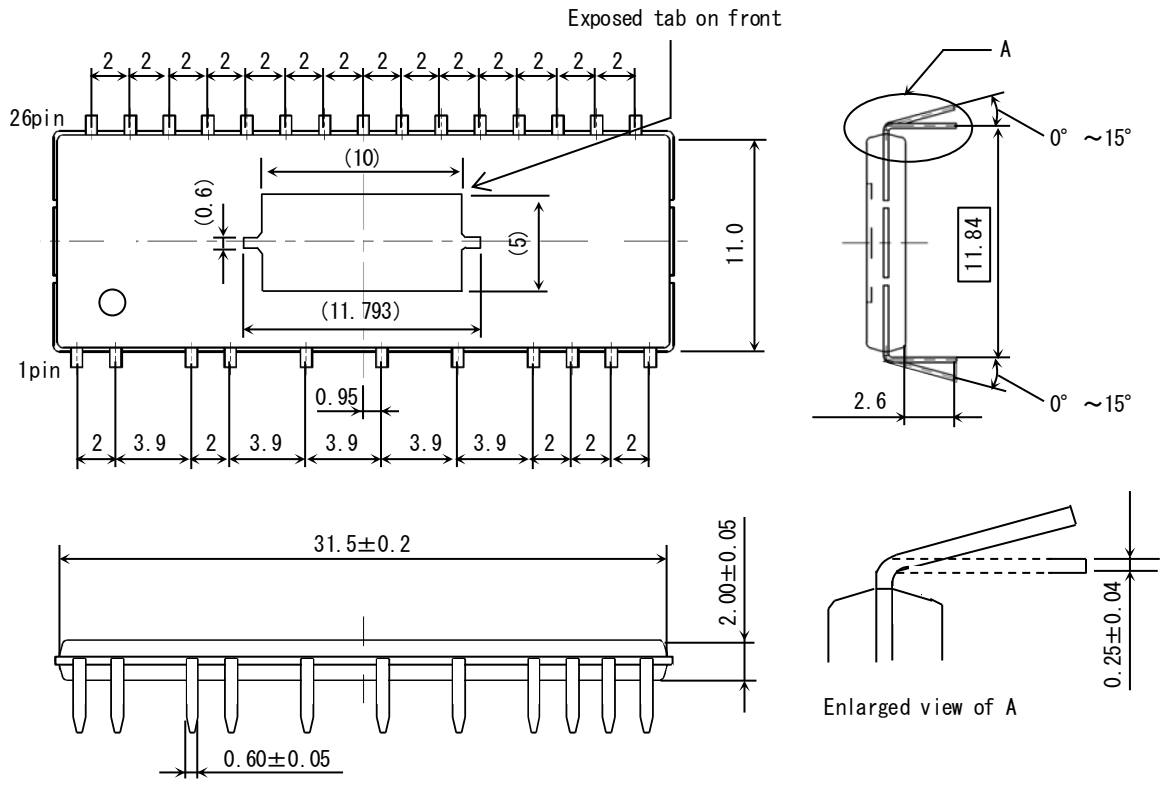
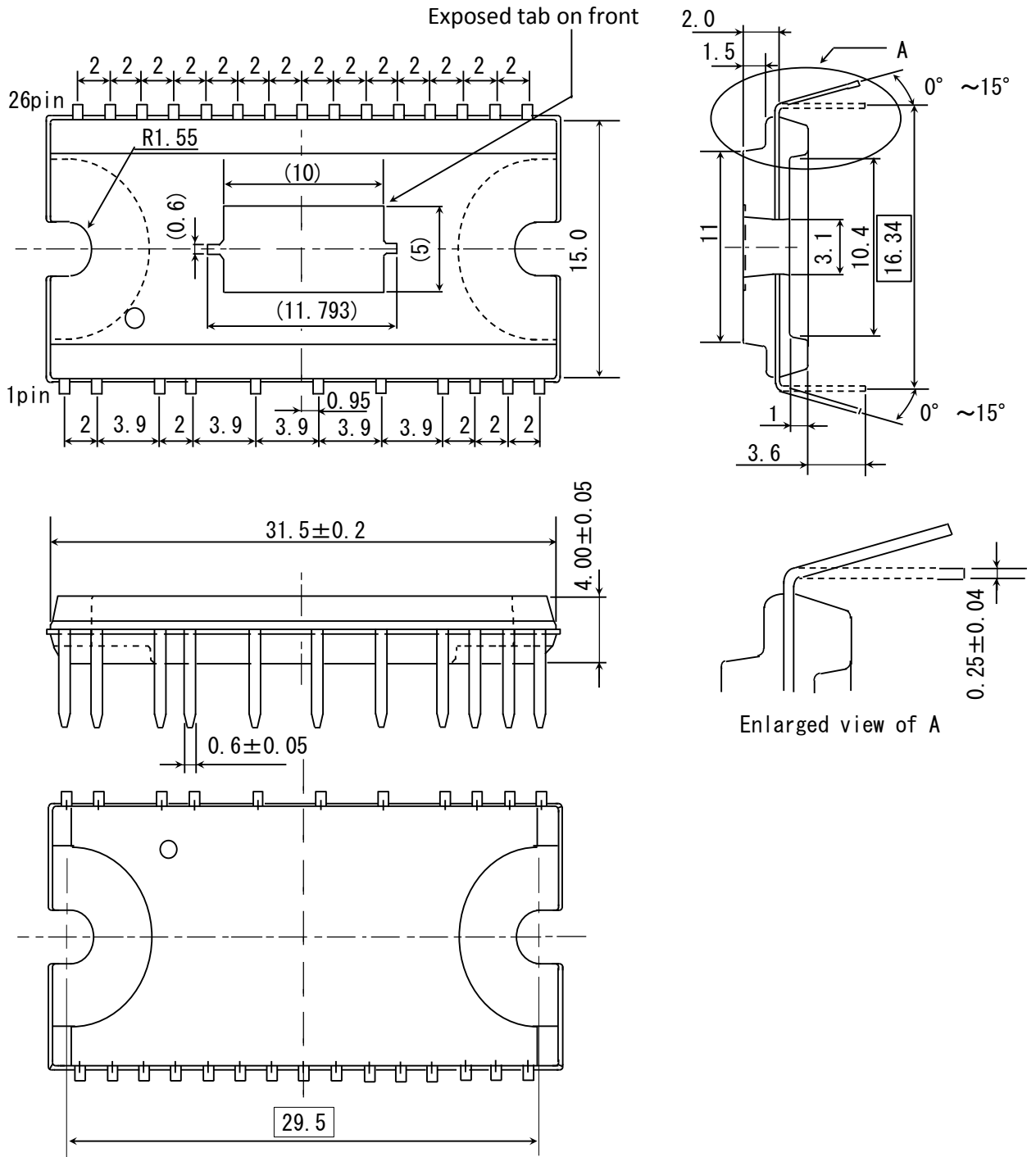## 4. Dimensions

FIGURE B: Dimensions of DIP26

FIGURE C: Dimensions of SOP26

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FIGURE D: Dimensions of DIP26N

Unit:mm

Note: Unless otherwise specified, the tolerance is ±0.1 in FIGURE B, FIGURE C and FIGURE D

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5. External Packaging

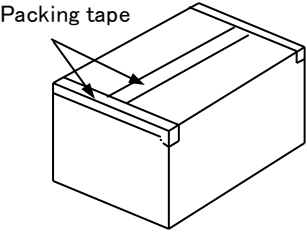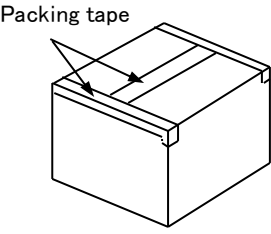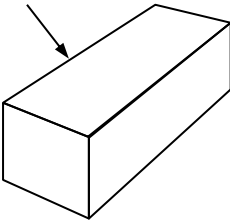FIGURE E shows the external packaging. In the case of reel, order quantities are basically multiples of 700.
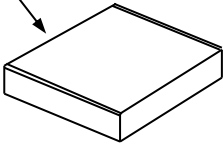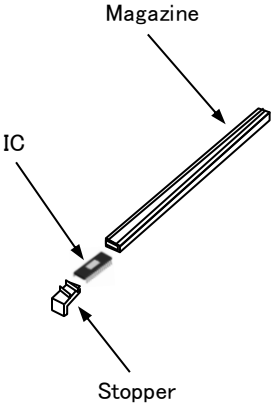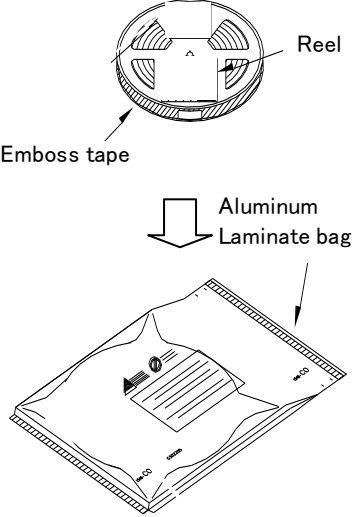
	Magazine (ECN30620P/ECN30620PN)	Reel (ECN30620F)
Outer box	Packing tape	Packing tape
Inner box	Inner box	Inner box
Magazine & Reel	Magazine IC Stopper The number of ICs; 15/magazine	Reel Emboss tape Aluminum Laminate bag The number of ICs; 700/Reel

FIGURE E: External Packaging

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6. Storage Conditions
The following conditions are applied to ECN30620F (SOP26).
   (1) Before opening the moisture prevention bag (aluminum laminate bag)
         Temperature: 5 to 35℃
         Humidity: 85%RH or lower
         Period: less than 2 years

   (2) After opening the moisture prevention bag (aluminum laminate bag)
         Temperature: 5℃ to 30℃
         Humidity: 70%RH or lower
         Period: less than 1 week (from opening the bag to reflow soldering)

   (3) Temporal strage after opening the moisture prevention bag
      When ICs are stored temporarily after opening the bag they should be returned into the bag with desiccant within 10 minutes. Then, the open side of the bag should be folded under twice, and closed with adhesive tape. And it should be kept in the following conditions.
         Temperature: 5℃ to 35℃
         Humidity: 85%RH or lower
         Period: less than 1 month

   ※ When the period of (1) to (3) is expected to expire, it is recommended to store the ECN30620F (SOP26) in a drying furnace (30%RH or lower) at ordinary temperature.

   (4) Baking process
      When the period of (1) to (3) has expired, the ECN30620F (SOP26) should be baked in accordance with the following conditions. (However, when the ECN30620F (SOP26) is stored in a drying furnace (30%RH or lower) at ordinary temperature, there is no need to bake.)
      Do not bake the tape and the reel of the taping package because they are not heat resistant.
      Transfer the ECN30620F (SOP26) to a heat resistant container prior to baking.
         Temperature: 125±5℃
         Period: 16 to 24 hours

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Precautions for Safe Use and Notices

If semiconductor devices are handled inappropriate manner, failures may result. For this reason, be sure to read the latest version of "Instructions for Use of Hitachi High-Voltage Monolithic ICs" before use.

⚠	This mark indicates an item about which caution is required.
⚠ **CAUTION**	This mark indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury and damage to property.

⚠ CAUTION

(1) Regardless of changes in external conditions during use "absolute maximum ratings" should never be exceed in designing electronic circuits that employ semiconductors.
In the case of pulse use, furthermore,"safe operating area (SOA)"precautions should be observed.

(2) Semiconductor devices may experience failures due to accident or unexpected surge voltages. Accordingly, adopt safe design features, such as redundancy or prevention of erroneous action, to avoid extensive damage in the event of a failure.

(3) In cases where extremely high reliability is required (such as use in nuclear power control, aerospace and aviation, traffic equipment, life-support-related medical equipment, fuel control equipment and various kinds of safety equipment), safety should be ensured by using semiconductor devices that feature assured safety or by means of user's fail-safe precautions or other arrangement. Or consult Hitachi's sales department staff.

(If a semiconductor devices fails, there may be cases in which the semiconductor device, wiring or wiring pattern will emit smoke or cause a fire or in which the semiconductor device will burst)

NOTICES

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http://www.hitachi-power-semiconductor-device.co.jp/en/