

250V 3-Phase High Side & Low Side Gate Drive IC

Description

The BL8288 is 3 phase high voltage, high speed power MOSFET driver with independent high and low side referenced output channels based on P_SUB P_EPI process. The floating channel can be used to drive an N-channel power MOSFET in the high side configuration which operates up to 250V. Logic inputs are compatible with standard CMOS or LS TTL output, down to 3.3V logic.

The BL8288 output drivers feature a high pulse current buffer stage designed for minimum driver cross-conduction. Propagation delays are matched to simplify use in high frequency applications.

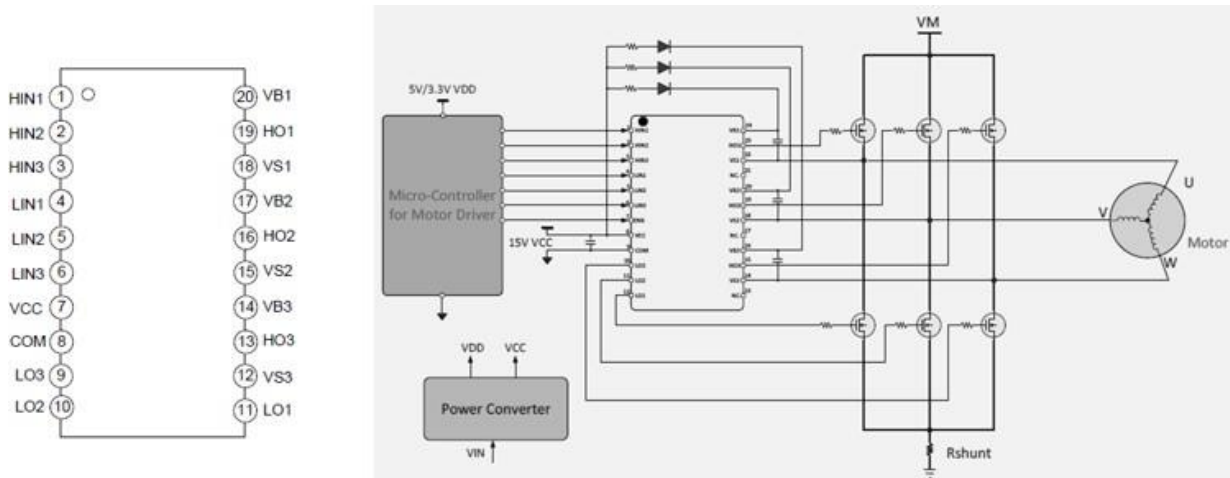
Features

- Fully operational to 250V
- 3.3/5/15V input logic compatible
- VCC range from 5.0 to 20V
- 1.5A/1.8A(typ.) current capability
- Deadtime 250ns (typ.)
- UVLO for VCC and VBS
- Tolerant to negative transient voltage
- Matched propagation delay
- TSSOP20, QFN24, CPC20 package available

Application

- Power Motor Driver
- Half-Bridge Power Converters
- Full-Bridge Power Converters

BL8288 Package & Simplified Application

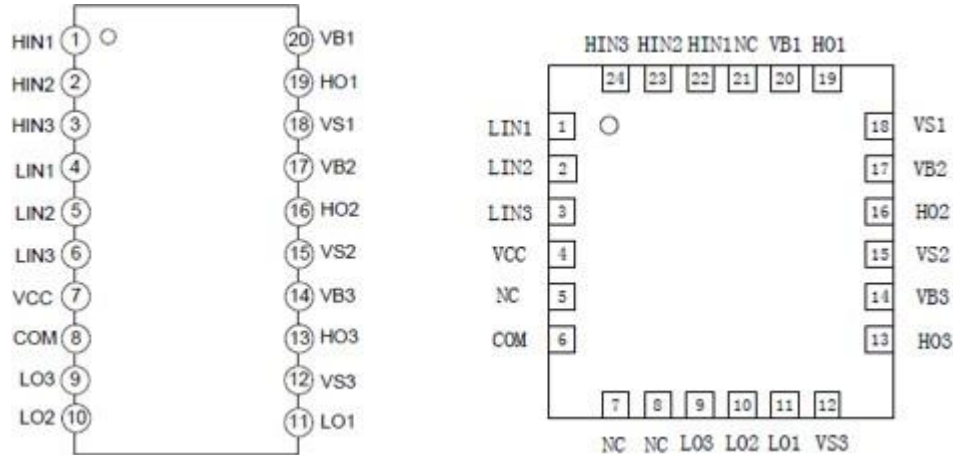


Order Information

Part No.	Package	Quality	Operation Temp T _A .
BL8288T	TSSOP20	4000	-40~125 °C
BL8288Q	QFN24	4000	-40~125 °C
BL8288C	CPC20	6000	-40~125 °C

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Pin Descriptions



NAME	Type	TSSOP20/CPC20	QFN24	DESCRIPTION
HIN1	I	1	22	Logic input for phase-1 high-side gate driver
HIN2	I	2	23	Logic input for phase-2 high-side gate driver
HIN3	I	3	24	Logic input for phase-3 high-side gate driver
LIN1	I	4	1	Logic input for phase-1 low-side gate driver
LIN2	I	5	2	Logic input for phase-2 low-side gate driver
LIN3	I	6	3	Logic input for phase-3 low-side gate driver
VCC	P	7	4	Logic and low-side gate drivers power supply voltage
COM	P	8	6	Logic ground and low-side gate drivers' ground
LO3	O	9	9	Phase-3 low-side gate driver output
LO2	O	10	10	Phase-2 low-side gate driver output
LO1	O	11	11	Phase-1 low-side gate driver output
VS3	P	12	12	Phase-3 high-side driver floating supply offset voltage
HO3	O	13	13	Phase-3 high-side driver output
VB3	P	14	14	Phase-3 high-side driver floating supply
VS2	P	15	15	Phase-2 high-side driver floating supply offset voltage
HO2	O	16	16	Phase-2 high-side driver output
VB2	P	17	17	Phase-2 high-side driver floating supply
VS1	P	18	18	Phase-1 high-side driver floating supply offset voltage
HO1	O	19	19	Phase-1 high-side driver output
VB1	P	20	20	Phase-1 high-side driver floating supply
NC	NC		5, 7, 8, 21	

250V 3-Phase High Side & Low Side Gate Drive IC
Absolute Maximum Ratings ($T_A=25^{\circ}\text{C}$)

Parameter		Min.	Max.	Unit
VB1,VB2,VB3	High side floating supply	-0.3	300	V
VS,VS2,VS3	High side floating supply return	VB-25	VB+0.3	
HO1,HO2,HO3	High side gate drive output	VS-0.3	VB+0.3	
VCC	Low side and main power supply	-0.3	25	
LO1,LO2,LO3	Low side gate drive output	-0.3	VCC+0.3	
HIN1,HIN2,HIN3, LIN1,LIN2,LIN3	Logic input of HIN & LIN	-0.3	VCC+0.3	
dVs/dt	Allowable offset supply voltage transient		50	V/ns
Junction temp.	T_J	-40	150	$^{\circ}\text{C}$
Operation temp.	T_A	-40	125	
Storage temp.	T_{stg}	-65	150	
Thermal resistance	θ_{JA}		160	$^{\circ}\text{C}/\text{W}$

Recommended operating conditions ($T_A=25^{\circ}\text{C}$)

Parameter		Min.	Max.	Unit
VB1,VB2,VB3	High side floating supply	-0.3	250	V
VS,VS2,VS3	High side floating supply return	VB-20	VB+0.3	
HO1,HO2,HO3	High side gate drive output	VS-0.3	VB+0.3	
VCC	Low side and main power supply	5	20	
LO1,LO2,LO3	Low side gate drive output	-0.3	20.0	
HIN1,HIN2,HIN3, LIN1,LIN2,LIN3	Logic input of HIN & LIN	-0.3	20.0	
Operation temp.	T_A	-40	125	$^{\circ}\text{C}$

250V 3-Phase High Side & Low Side Gate Drive IC
Electrical Characteristics ($V_{CC}=V_{BS}=15.0V$, $C_L=1000pF$, $T_A=25\text{ }^\circ\text{C}$)

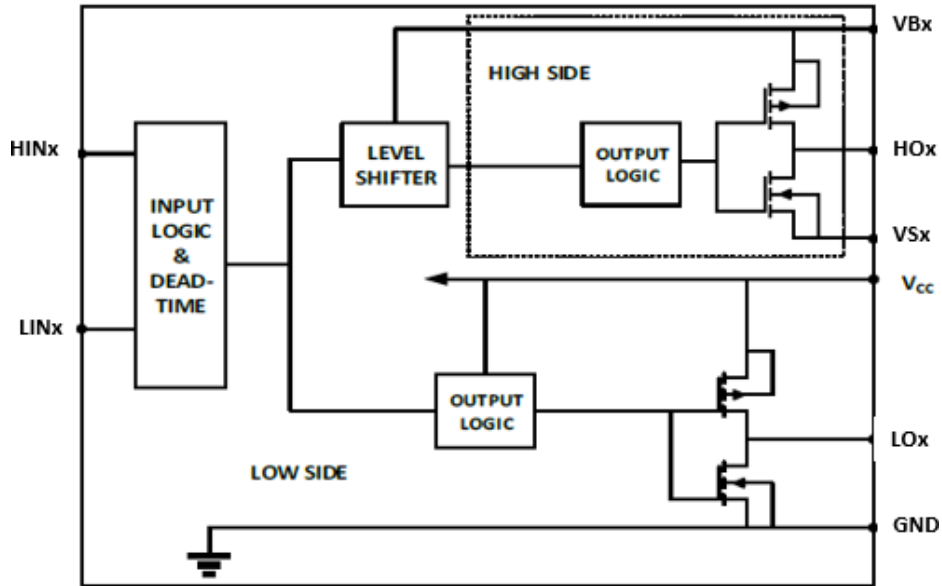
Parameter		Test Condition	Min.	Typ.	Max.	Unit
Supply Current						
V _{CC} disable current	I _{CC_OFF}	INH, INL Floating		205		uA
V _{CC} enable current	I _{CC_ON}	INH, INL is "1"		225		uA
V _B enable current	I _{B_ON}			32		uA
Leakage current	I _{LK}	V _B =V _S =250V		0.1		uA
HINx//LINx						
Input high level voltage	V _{INH}		2.5		-	V
Input low level voltage	V _{INL}		0		0.8	V
Pull down resistance	R _{PD}			280		kΩ
UVLO						
V _{BS} UVLO rising threshold	V _{BSUV_R}			3.85		V
V _{BS} UVLO falling threshold	V _{BSUV_F}			3.65		V
V _{BS} UVLO Hysteresis	V _{BSUV_H}			200		mV
V _{CC} UVLO rising threshold	V _{CCUV_R}			4.20		V
V _{CC} UVLO falling threshold	V _{CCUV_F}			4.00		V
V _{CC} UVLO Hysteresis	V _{CCUV_H}			200		mV
Low-Side/High-Side Output						
Low-Side output high voltage	V _{OHL}	I _O =20mA		80		mV
Low-Side output low voltage	V _{OLL}	I _O =20mA		40		mV
Low-Side source peak current	I _{OHL}	V _O =0, V _{IN} =5V		1.5		A
Low-Side sink peak current	I _{OLL}	V _O =15V, V _{IN} =0V		1.8		A
Allowable negative VS voltage for HIN1,2,3 signal propagation to HO1,2,3	V _{SN}	V _{BS} =15V		-9.0		V

250V 3-Phase High Side & Low Side Gate Drive IC
Dynamic Electrical Characteristics ($V_{CC}=V_{BS}=15.0V$, $C_L=1000pF$, $T_A=25\text{ }^{\circ}C$)

Symbol	Definition	Min.	Typ.	Max.	Unit
T_{ONH}	High side turn on propagation delay		350	450	ns
T_{OFFH}	High side turn off propagation delay		100	200	ns
T_{ONL}	Low side turn on propagation delay		350	450	ns
T_{OFFL}	Low side turn off propagation delay		100	200	ns
DT	Dead time		250	350	ns
MT	Dealy matching time(T_{ON} , T_{OFF})		10	50	ns
T_R	Turn on rising time		25		ns
T_F	Turn off falling time		25		ns

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Block Diagram



FUNCTION DESCRIPTION

LOW SIDE POWER SUPPLY: VCC

VCC is the low side supply and it provides power to both input logic and low side output power stage. The built-in under-voltage lockout circuit enables the device to operate at sufficient power when a typical VCC supply voltage higher than $VCC_{UV+} = 4.20V$ is present, shown as Figure. 1. The BL8288 shuts down all the gate driver outputs, when the VCC supply voltage is below $VCC_{UV-} = 4.00V$, shown as Figure. 1. This prevents the external power devices against extremely low gate voltage levels during on-state which may result in excessive power dissipation.

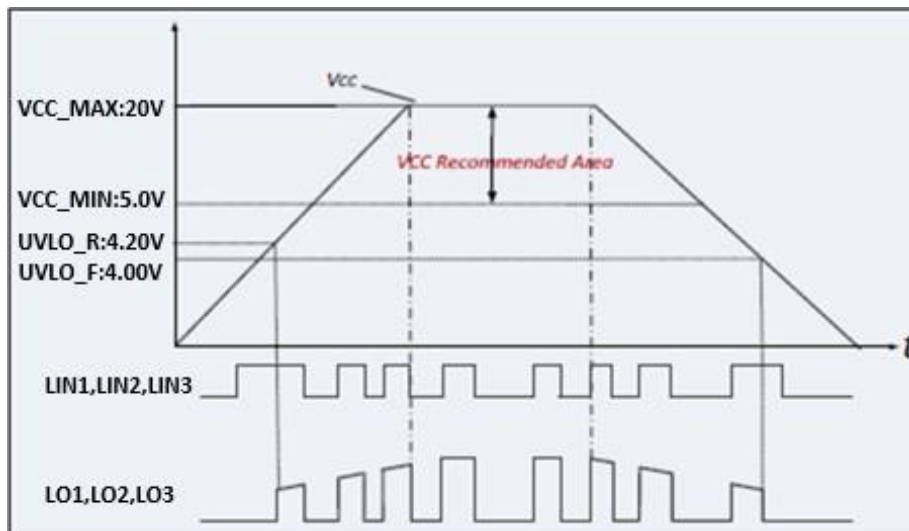


Figure. 1 VCC supply UVLO operating area

250V 3-Phase High Side & Low Side Gate Drive IC
HIGH SIDE POWER SUPPLY: VBS (VB1-VS1, VB2-VS2, VB3-VS3)

VBS is the high side supply voltage. The total high side circuitry may float with respect to COM following the external high side power device emitter/source voltage. Due to the internal low power consumption, the entire high side circuitry may be supplied by bootstrap topology connected to VCC, and it may be powered with small bootstrap capacitors. The device operating area as a function of the supply voltage is given in Figure. 2.

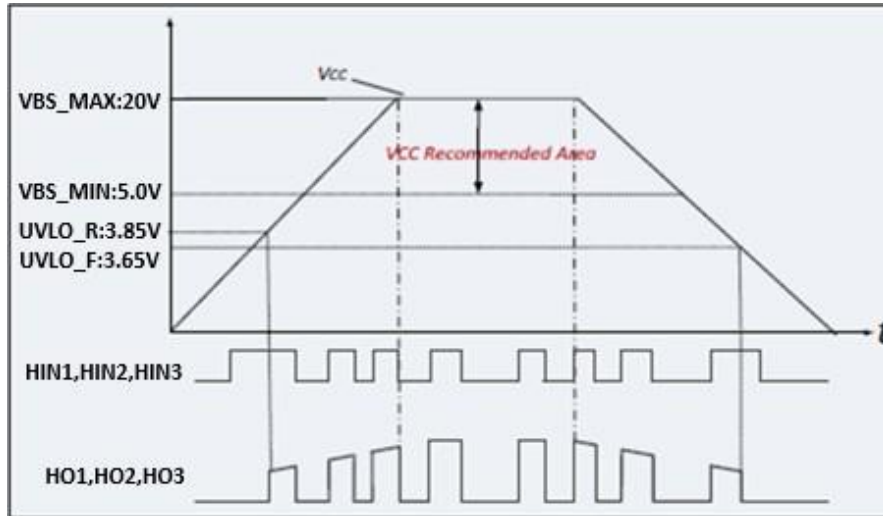


Figure. 2 VBS supply UVLO operating area

LOW SIDE AND HIGH CONTROL INPUT LOGIC: HIN&LIN (HIN1, 2, 3/LIN1, 2, 3)

The Schmitt trigger threshold of each input is designed low enough to guarantee LSTTL and CMOS compatibility down to 3.3V controller outputs. Input Schmitt trigger and advanced noise filtering provide noise rejection of short input pulses. An internal pull-down resistor of about 280k (positive logic) pre-biases each input during VCC supply start-up state. The minimum recommended input pulse-width is 300ns for proper operation of the driver.

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SHOOT-THROUGH PREVENTION

The BL8288 is equipped with shoot-through protection circuitry (also known as cross conduction prevention circuitry). Figure. 3 shows how this protection circuitry prevents both the high- and low-side switches from conducting at the same time. When the inputs controlling both high-side and low-side drivers are both logic HIGH, then both driver outputs are pulled down to logic LOW to shut down two power devices in the same bridge.

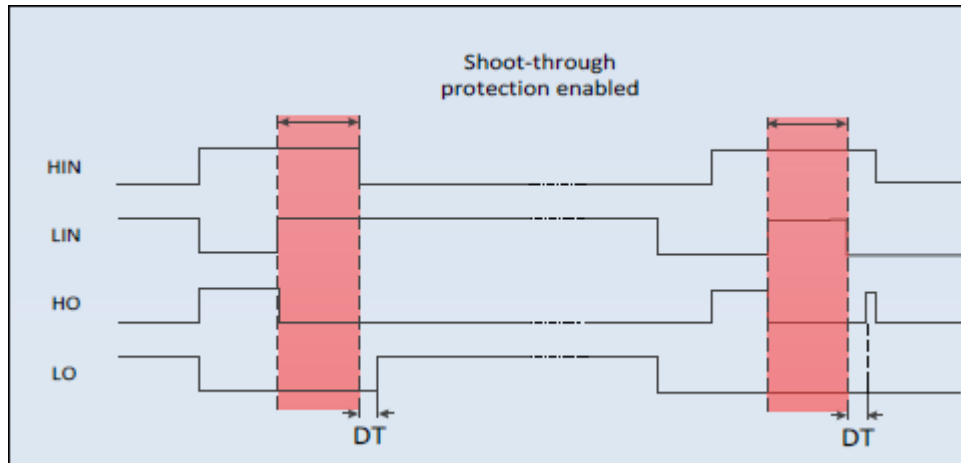


Figure. 3 Shoot-through prevention

DEAD TIME PROTECTION

The BL8288 features integrated fixed dead time protection circuitry. The dead time feature inserts a time period (a minimum dead time) in which both the high- and low-side power switches are held off. This is done to ensure that the power switch has fully turned off before the second power switch is turned on. This minimum dead time is automatically inserted whenever the external dead time is shorter than DT. External dead times larger than DT are not modified by the gate driver. Figure. 4 illustrates the dead time period and the relationship between the output gate signals.

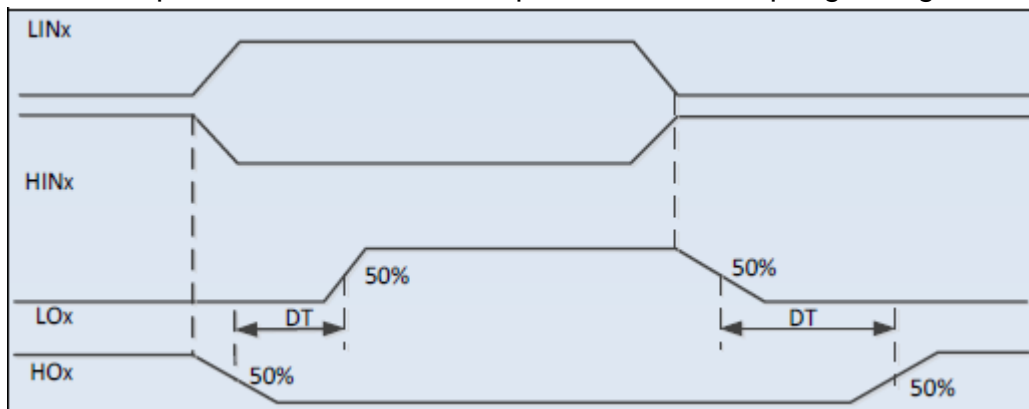
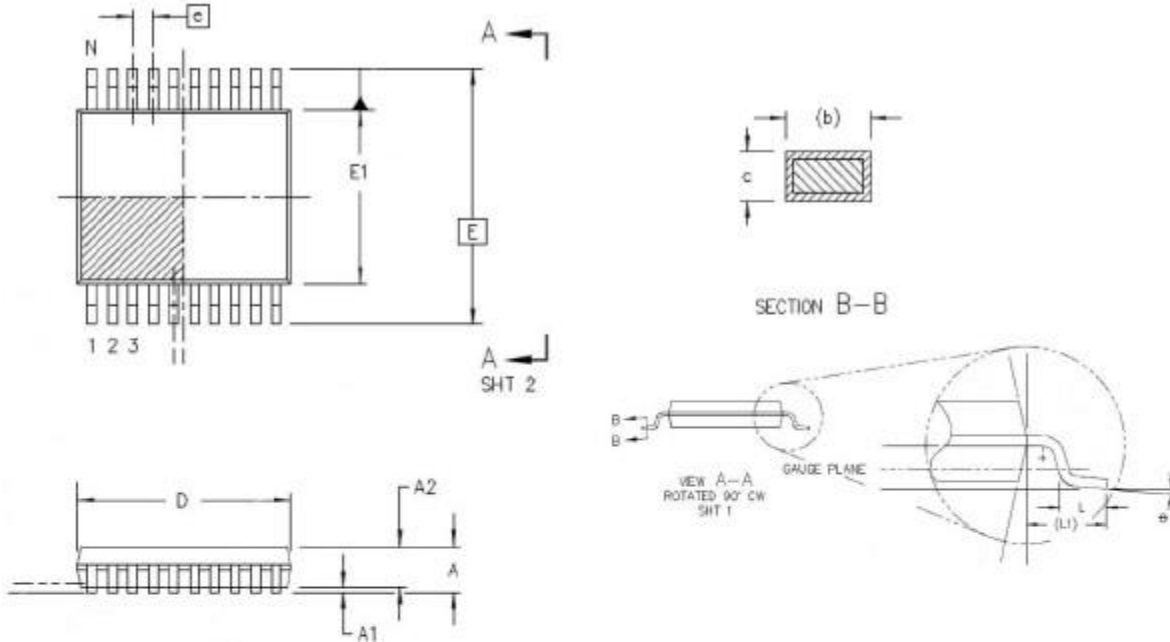


Figure. 4 Dead time protection

250V 3-Phase High Side & Low Side Gate Drive IC

Package Information

TSSOP20



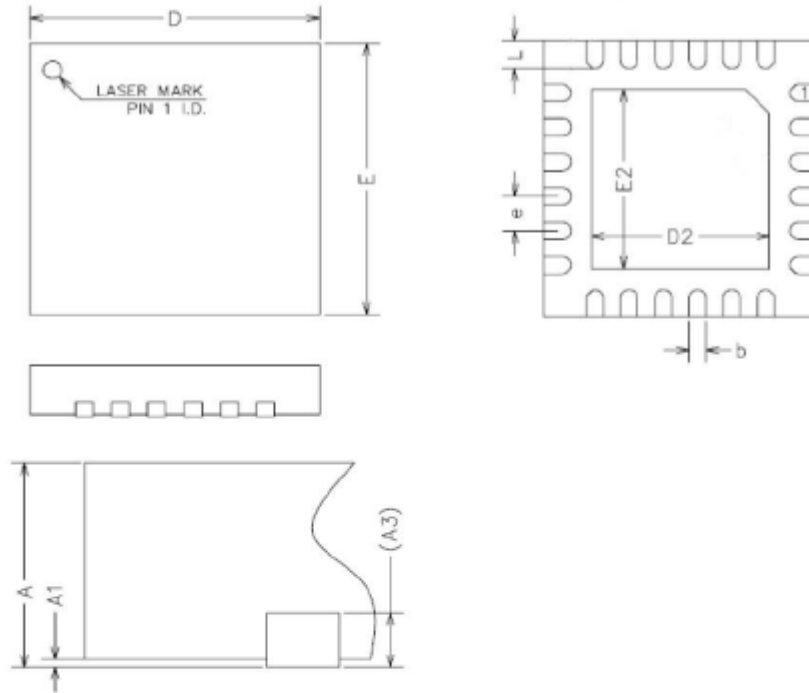
Symbol	Dimensions(mm)		
	Min.	Nom.	Max.
A	-	-	1.20
A1	0.05	-	0.15
A2	0.80	1.00	1.05
b	0.19	-	0.30
c	0.09	-	0.20
e	0.65BSC		
D	6.40	6.50	6.60
E	6.4 BSC		
E1	4.30	4.40	4.50
L	0.45	0.60	0.75
L1	1.00 REF		
θ	0°	-	8°

Notes:

1. All dimensions refer to JEDEC MO-153 AC
2. All dimensions are in mm

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QFN4X4-24



Symbol	Dimensions(mm)		
	Min.	Nom.	Max.
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A3	0.20 REF		
b	0.18	0.25	0.30
D	4.00 BSC		
D2	2.50	2.65	2.80
E	4.00 BSC		
E2	2.50	2.65	2.80
e	0.50 BSC		
L	0.35	0.40	0.45

Notes:

1. All dimensions refer to JEDEC MO-220 WGGD-8
2. All dimensions are in mm

250V 3-Phase High Side & Low Side Gate Drive IC

CPC20

尺寸 标注	最小(mm)	最大(mm)	尺寸 标注	最小(mm)	最大(mm)
A	6.50	6.70	C	0.85	1.05
A1	0.76	0.86	C1	0.00	0.15
e	0.53 (BSC)		C2	0.15	0.18
B	2.50	2.70	L	0.40	0.60
B1	3.85	4.15	θ	0°	8°
b	0.16	0.26			

