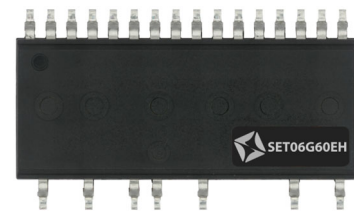


Description

SET06G60EH is a 3-phase Intelligent Power Module (IPM) designed for advanced appliance motor drive applications such as energy efficient fans and pumps. SET06G60EH contains six IGBTs and FRDs, three half-bridge gate drive HVICs with temperature sensing in a compact package fully isolated and optimized for thermal performance. The modules are optimized for low EMI characteristics.

Features

- 600V/6A 3-phase IGBT inverter with integrated gate drivers
- Works with 3.3V/5V MCU and Active-High interface
- HVIC for under-voltage protection and temperature monitoring
- Integrated bootstrap functionality
- Isolation Rating 1500V



SOP-23L

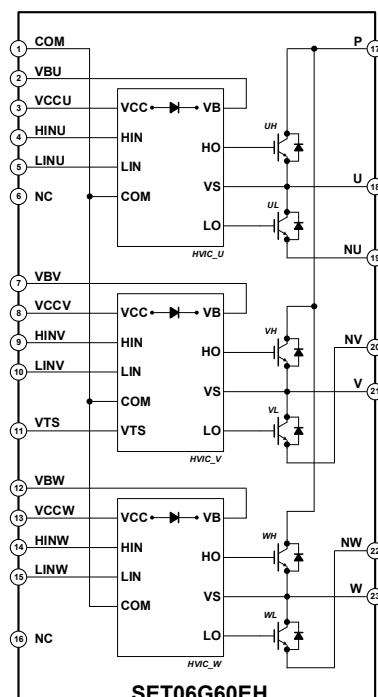
Applications

- Motor Controls
- Pumps/Fans

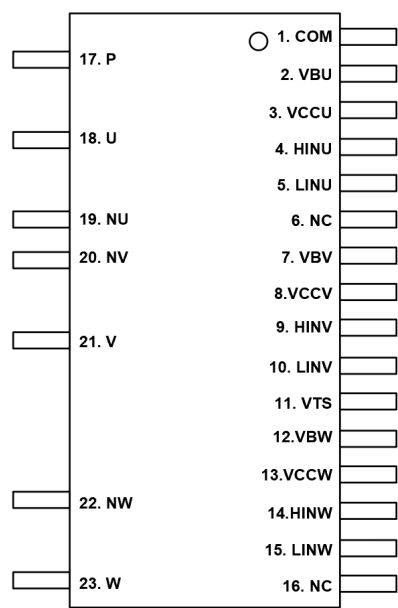
Package Marking and Ordering Information

Part #	Package	Packing	Quantity	Bootstrap Diode	V _{TS} Temperature Sense
SET06G60EH	SOP-23L	Tape & Reel	650	Yes	Yes

Internal Electrical Schematic



Pin-Out Description



Top View

PIN Number	PIN Name	Description
1	COM	Logic Ground
2	VBU	High Side Floating Supply Voltage U
3	VCCU	Low Side Supply Voltage U
4	HINU	Logic Input for High Side Gate Driver - Phase U
5	LINU	Logic Input for Low Side Gate Driver - Phase U
6	NC	Not Connected
7	VBV	High Side Floating Supply Voltage V
8	VCCV	Low Side Supply Voltage V
9	HINV	Logic Input for High Side Gate Driver - Phase V
10	LINV	Logic Input for Low Side Gate Driver - Phase V
11	VTS	Temperature-sensing Voltage Output
12	VBW	High Side Floating Supply Voltage W
13	VCCW	Low Side Supply Voltage W
14	HINW	Logic Input for High Side Gate Driver - Phase W
15	LINW	Logic Input for Low Side Gate Driver - Phase W
16	NC	Not Connected
17	P	DC Bus Voltage Positive
18	U	Output - Phase U, High Side Floating Supply Offset U
19	NU	Phase U Low Side Source
20	NV	Phase V Low Side Source
21	V	Output - Phase V, High Side Floating Supply Offset V
22	NW	Phase W Low Side Source
23	W	Output - Phase W, High Side Floating Supply Offset W

Absolute Maximum Ratings

Symbol	Parameter	Maximum	Unit
V_{PN}	Supply Voltage between P-NU, NV, NW	450	V
$V_{PN(surge)}$	Supply Voltage(surge) between P-NU, NV, NW	500	V
V_{CES}	Collector-Emitter Voltage	650	V
I_C	DC Output Current per IGBT, $T_c=100^{\circ}\text{C}$	6	A
I_{CP}	Pulsed Output Current per IGBT, $V_{GE}=15\text{V}$, t_p limited by $T_{vj\ max}/$ Less than 1ms Pulse Width	24	A
P_D	Maximum Power Dissipation per IGBT, $T_c=25^{\circ}\text{C}$	22	W
V_{CC}	Control Supply Voltage	20	V
V_{BS}	High-side Bias Voltage	20	V
V_{IN}	Input Signal Voltage	$-0.5\sim V_{CC}+0.5$	V
T_J	Operating Junction Temperature	$-40\sim 150$	$^{\circ}\text{C}$
T_C	Module Case Operation Temperature	$-40\sim 125$	$^{\circ}\text{C}$
T_{stg}	Storage Temperature	$-40\sim 125$	$^{\circ}\text{C}$
$R_{th(j-c)Q}$	Junction to Case Thermal Resistance, one IGBT	5.5	$^{\circ}\text{C}/\text{W}$
$R_{th(j-c)F}$	Junction to Case Thermal Resistance, one FRD	7.0	$^{\circ}\text{C}/\text{W}$
V_{ISO}	Isolation Voltage (1 min)	1500	V_{rms}
V_{RRM}	Integrated Bootstrap Diode Reverse Voltage	600	V

Recommended Operating Conditions (T_a=25° C, unless otherwise specified.)

Symbol	Definition	Min.	Typ.	Max.	Unit
V _{PN}	P-N Supply Voltage	–	300	400	V
V _{CC}	Control Supply Voltage	13.5	15	16.5	V
V _{BS}	High-Side Bias Voltage	13.5	15	16.5	V
dV _{CC} /dt dV _{BS} /dt	Control Voltage Fluctuations	-1	–	1	V/μs
V _{IN(ON)}	Input ON Threshold Voltage	3	–	V _{CC}	V
V _{IN(OFF)}	Input OFF Threshold Voltage	0	–	0.8	V
t _{dead}	Deadtime Inserted	1	–	–	μs
f _{PWM}	PWM Switching Frequency	–	–	20	kHz
V _{COM}	COM Voltage Fluctuations	-5	–	5	V

Static Electrical Characteristics (T_a = 25°C unless otherwise specified.)

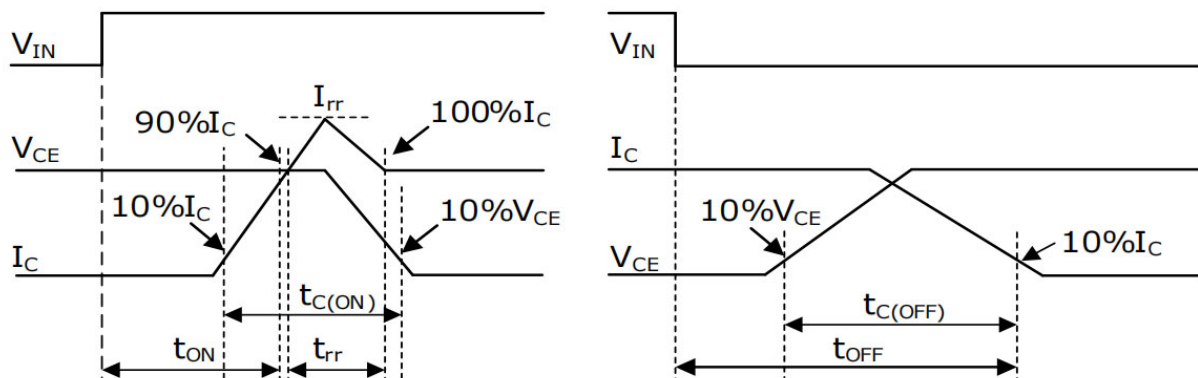
Inverter Part

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
V _{CE(SAT)}	Collector-Emitter Saturation Voltage	V _{CC} =V _{BS} =15V, V _{IN} =5V, I _C =6A	—	1.7	2.0	V
V _{EC}	FRD Forward Voltage	V _{IN} =0V, I _F =6A	—	1.35	1.6	V
I _{CES}	Collector-Emitter Leakage Current	V _{CE} =V _{CES} , V _{GE} =0V, T _J =25°C	—	—	50	μA
t _{ON}	Switching Times	V _{PN} =400V, V _{CC} =V _{BS} =15V, I _C =6A V _{IN} =0~5V, Inductive Load	—	470	—	ns
t _{c(ON)}			—	300	—	ns
t _{OFF}			—	440	—	ns
t _{c(OFF)}			—	90	—	ns
t _{rr}			—	228	—	ns
Eon	Switching Loss		—	373	—	μJ
Eoff			—	119	—	μJ

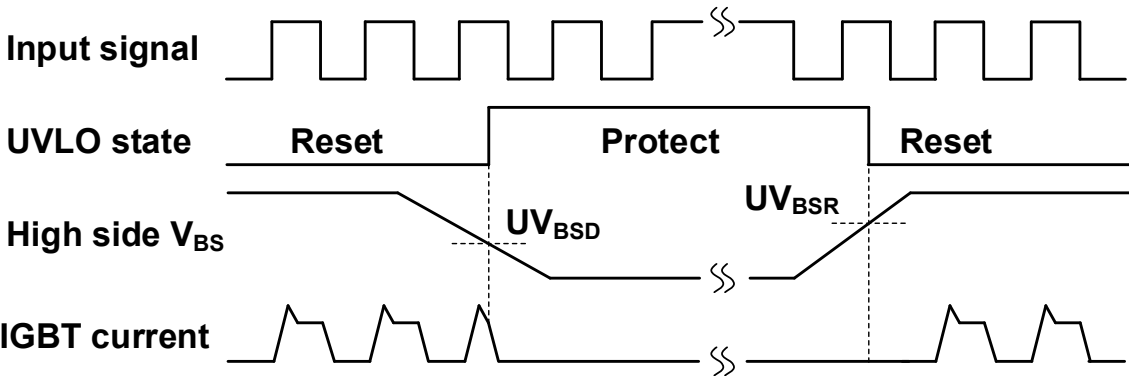
Control Part

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
I_{QCC}	Quiescent VCC Supply Current	$V_{CC}=15V, V_{IN}=5V$	400	570	800	μA
I_{QBS}	Quiescent VBS Supply Current	$V_{BS}=15V, V_{IN}=5V$	50	114	200	μA
UV_{BSD}	High-Side Under-Voltage Protection	V_{BS} Detection Level	6.2	6.9	8	V
UV_{BSR}		V_{BS} Reset Level	7	7.8	9	V
UV_{CCD}	Low-Side Under-Voltage Protection	V_{CC} Detection Level	7.7	8.4	9.2	V
UV_{CCR}		V_{CC} Reset Level	8.3	9.2	9.5	V
V_{IH}	ON Threshold Voltage	$V_{CC}=10\sim 20V$	2.5	—	—	V
V_{IL}	OFF Threshold Voltage	$V_{CC}=10\sim 20V$	—	—	1	V
I_{IH}	High Input Bias Current	$V_{IN}=5V$	5	10	15	μA
I_{IL}	Low Input Bias Current	$V_{IN}=0V$	-1	—	1	μA
R_{BSD}	Bootstrap Diode On-State Resistor		-	525	-	Ohm
V_{TS}	HVIC Temperature Sensing Voltage Output	$V_{CC}=15V, T=25^{\circ}C$	0.6	0.79	0.98	V
		$V_{CC}=15V, T=100^{\circ}C$	2.06	2.25	2.44	V

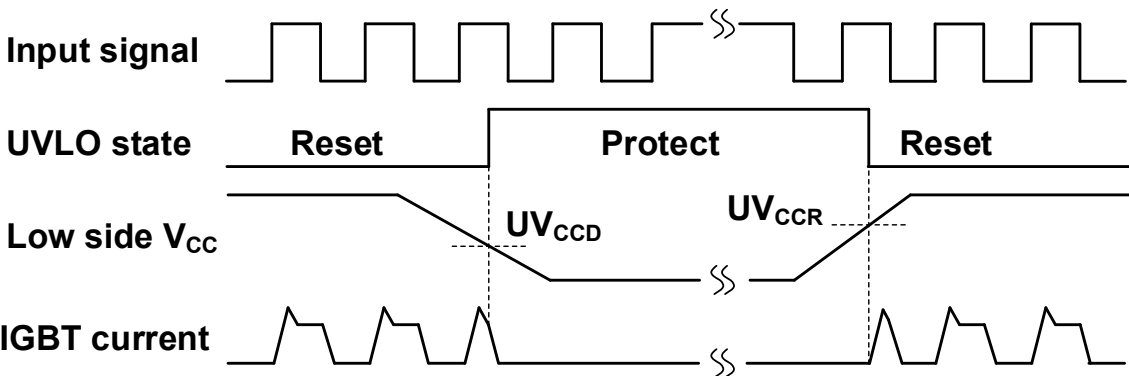
Function Description



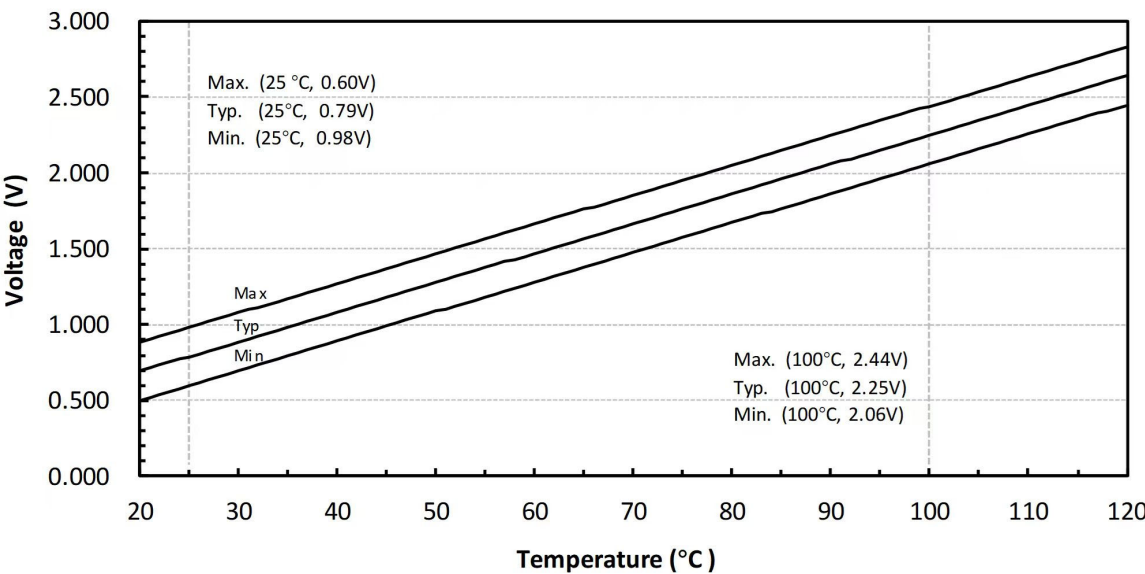
Switching Time Definition



Undervoltage protect (High side)

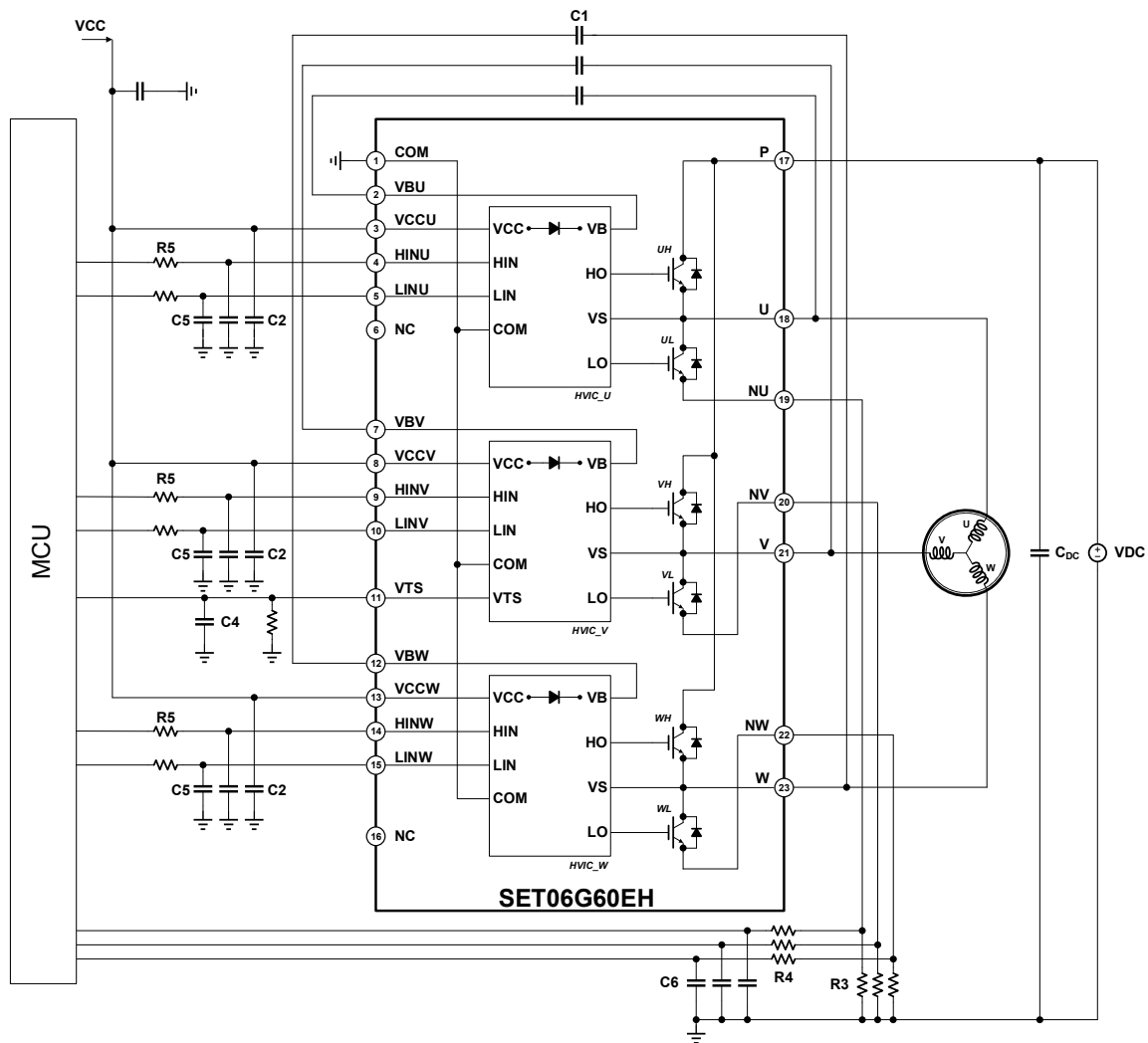


Undervoltage protect (Low side)



HVIC Temperature Sensing Voltage Output

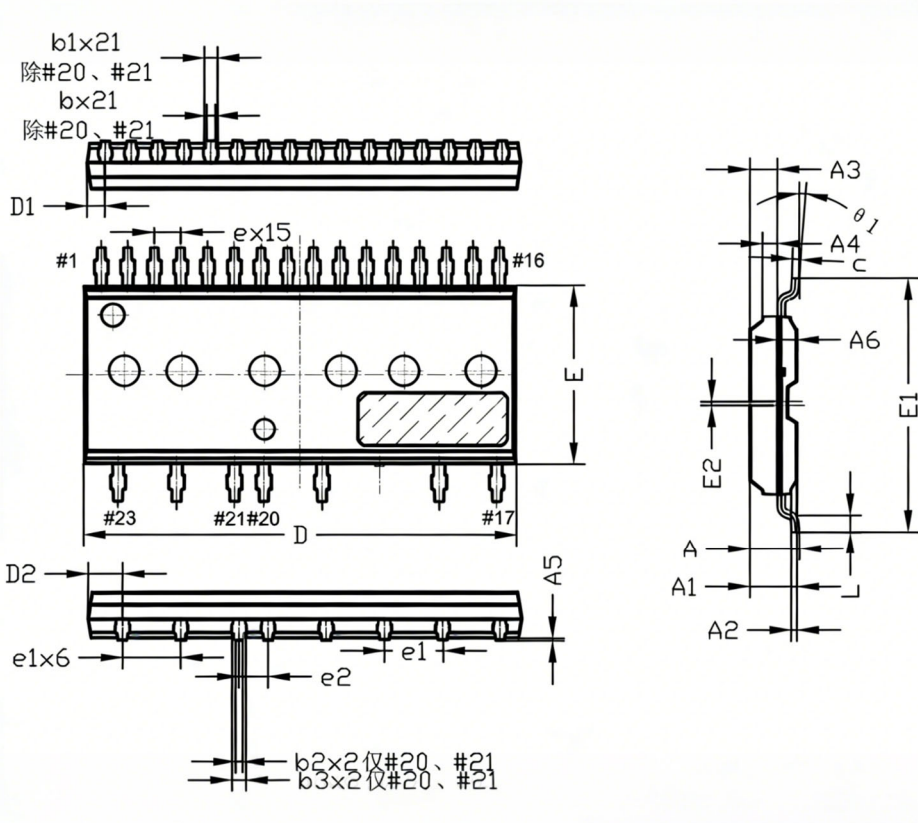
Typical Application Connection



Notes:

1. Input drive is High-Active type. To prevent malfunction, the wiring of each input should be as short as possible. When using RC coupling circuit, make sure the input signal level meet the turn-on and turn-off threshold voltage.
2. Thanks for HVIC inside modules, direct coupling to MCU without any opto-coupler or transformer isolation is possible.
3. The terminals of VTS is used to temperature detection, if you don't want to use it, can pull-down the terminal with a 100 K Ω resistor to GND.
4. All capacitors should be mounted as close to the terminals of the IPM as possible.
5. The HIN and LIN have internal pull-down resistors. Additional pull-down resistors can be connected if necessary.
6. Bootstrap negative electrodes should be connected to U, V, W terminals directly and separated from the main output wires.
7. High frequency capacitor C1 (greater than 2.2 μ F) is used as the bootstrap-up capacitor to absorb high frequency ripple.

Package Outline



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	--	--	3.50
A1	2.90	3.10	3.30
A2	0.50(BSC)		
A3	1.85(BSC)		
A4	1.00(BSC)		
A5	0.10	0.15	0.20
A6	1.30(BSC)		
b	0.50	0.60	0.70
b1	--	--	1.00
b2	0.40	0.50	0.60
b3	--	--	1.00
c	0.45	0.50	0.55
D	28.80	29.00	29.20
D1	1.165(BSC)		
D2	2.275(BSC)		
E	11.80	12.00	12.20
E1	16.80	17.00	17.20
E2	0.25(BSC)		
e	1.778(BSC)		
e1	3.90(BSC)		
e2	1.65	1.95	2.25
L	1.30	1.50	1.70
01	2°	--	8°

General Notes

Application Information

For improved readability, the specification contains many application data points. When application information is given, it is advisory and does not form part of the specification for the device.

Life Support Applications

These devices are not designed for use in life support appliances, or systems where malfunction of these products can reasonably be expected to result in personal injuries. Customer using or selling these products for use in such applications do so at their own risk.

Content Disclaimer

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Revision History

Ver 1.0	Initial version
Ver 1.1	Update some parameters