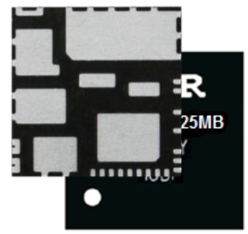
Data Sheet

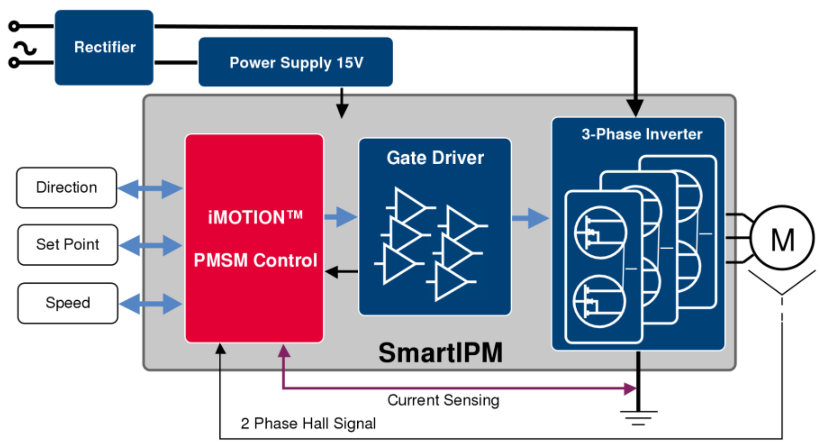
iMOTION™ Motion Controller Module for PM AC Fan

Quality Requirement Category: Industry

Features



- Complete 250V - 500V 3-phase inverter system in one chip
- Permanent Magnet Sinusoidal Motors Control by Hall sensors
  Only two low cost Hall elements required
- High efficiency control by quadratic phase advance curve
- Internal clock based on external RC
- 15V single power supply
  3.3V Integrated Voltage Regulator
- Integrated protection features:
  Dynamic overcurrent , Overtemperature ,
  Overspeed, Rotor lock, Undervoltage lockout
- Full Three Phase Gate Driver
- Integrated Bootstrap Diodes
- No heatsink required
- 12x12 mm^2 PQFN package



Applications

- PM fan motor control

Description

IRDM983-025MB, IRDM983-035MB are the complete PM motor controller including six power MOSFET, high voltage integrated circuit, high precision analog circuit and integrated digital control algorithm. The controller implements a Hall sensor based control algorithm for 3-phase sinusoidal permanent magnet motor fan applications.

Other than the IRDM982 the IRDM983 only requires two hall sensors.

The integrated digital controller does not require any programming.
Instead there are 16 load curves stored in the internal ROM that can be selected via two resistor pairs.

The IRDM983 is packaged in the 12 x 12 PQFN package and designed to dissipate the power loss through a PCB without the use of an external heatsink.

There are two products available depending on the power rating of the internal high voltage MOSFETs:

1) IRDM983-025MB – employs six MOSFETs 500V 2A and 600V high voltage IC

2) IRDM983-035MB – employs six MOSFETs 500V 3A and 600V high voltage IC

International
IOR Rectifier

PD19082016

IRDM983-025MB, IRDM983-035MB

Complete Motion Controller Module for PM AC fan

Features

- Complete 500V 3-phase inverter system in one chip
- No heat-sink required
- Permanent Magnet Sinusoidal Motors Control by two Hall sensors
- Selectable 4 or 12 pulse output per revolution[1)]
- High efficiency control by quadratic phase advance curve
- Internal clock based on external RC
- 15V single power supply
- 3.3V Integrated Voltage Regulator
- Dynamic overcurrent limit per temperature
- Over-temperature control
- Over-speed protection
- Rotor lock detection/protection
- Full Three Phase Gate Driver
- Integrated Bootstrap Diodes
- Under-voltage lockout

Typical Applications

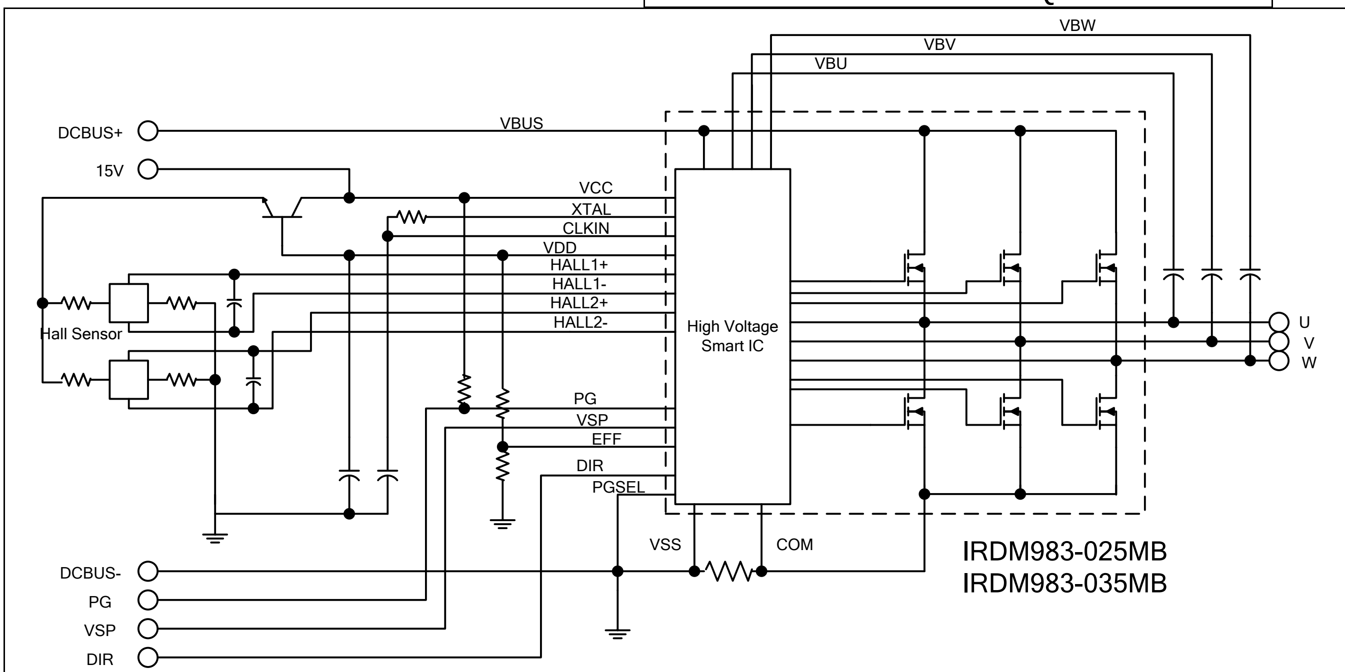
- Fan motor control

Product Summary

Topology	3 Phase AC
V_{OFFSET}	≤ 500 V for IRDM983-025MB, IRDM983-035MB
Control	Phase Advancement control
Feedback	DC Bus shunt, 2 Hall sensor
Temperature sensor	Integrated

Package

12mm x 12mm PQFN



1) When used with 8 poles motor. In general it is 1 pulse / 3 pulses per electrical revolution.

Revision History

Created new DS (April, 2015)
- Fixed part numbers typo (5 May 2015)
- Updated ESD level (19 August 2016)

Table of Contents

Introduction

IRDM983-025MB, IRDM983-035MB are the complete PM motor controller including six power MOSFET, high voltage integrated circuit, high precision analog circuit and digital control algorithm. There are two products depending on power rating of internal high voltage MOSFET listed below:

1) IRDM983-025MB – employs six MOSFET 500V 2A and 600V high voltage IC
2) IRDM983-035MB – employs six MOSFET 500V 3A and 600V high voltage IC

All two products are packaged in the 12 x 12 PQFN package and designed to dissipate the power loss through a mating PCB without an external heatsink. All two products contain exactly same control algorithm and analog functions. The controller implements a two Hall sensors based control algorithm for 3-phase sinusoidal permanent magnet motor fan applications. The control also employs high efficiency PM motor control algorithm based on a quadratic load curve stored in internal ROM. 16 possible curves are selectable.

All devices have an on-chip voltage regulator to derive the 3.3V, required by the digital logic, from the 15V (VCC) supply. The 3.3VDC regulated voltage pin is available externally for connection to Hall-effect sensors. The IC provides low power standby (less than 7mW) mode of operation that 3.3V power is cut off when VSP (Voltage Input) becomes less than 1.15V to provide further power efficient operation.

An integrated A/D Converter is used to acquire EFF load curve selection, temperature (internal temp sensing), and the VSP input that sets the voltage applied to the motor.
An internal temperature sensor is interfaced to the ADC and resulting digital conversion data is used to control the dynamic overcurrent setpoints as well as max overtemperature limit.

The protection functions include a supply under-voltage lockout (3.3V and 15VDC), over-speed protection, over-temperature limit and Over-current limitation protections. The reset circuitry includes a Power-On reset block and a reset input.

All devices do not require any programming. Default coefficients and system parameters are stored in internal ROM. The EFF input pin, used to adapt to specific motor and load to improve efficiency, can be used by means of two resistor pairs to choose one of 16 pre-stored load curves in ROM. DIR is a digital input pins which specify the motor direction command (CW or CCW).

All devices have an on-chip PLL to generate internal clocks. The PLL requires an external low frequency reference clock (32,768 Hz). The clock can be provided through an RC network connected to CLKIN and XTAL pins.

The IRDM983-025MB, IRDM983-035MB integrate high and low side gate drivers for applications up to 500V, it includes integrated Bootstrap FET that emulate bootstrap diode function and six power MOSFETs. The simplified block diagram is shown in Figure 1 in terms of hardware elements.

Simplified Block Diagram

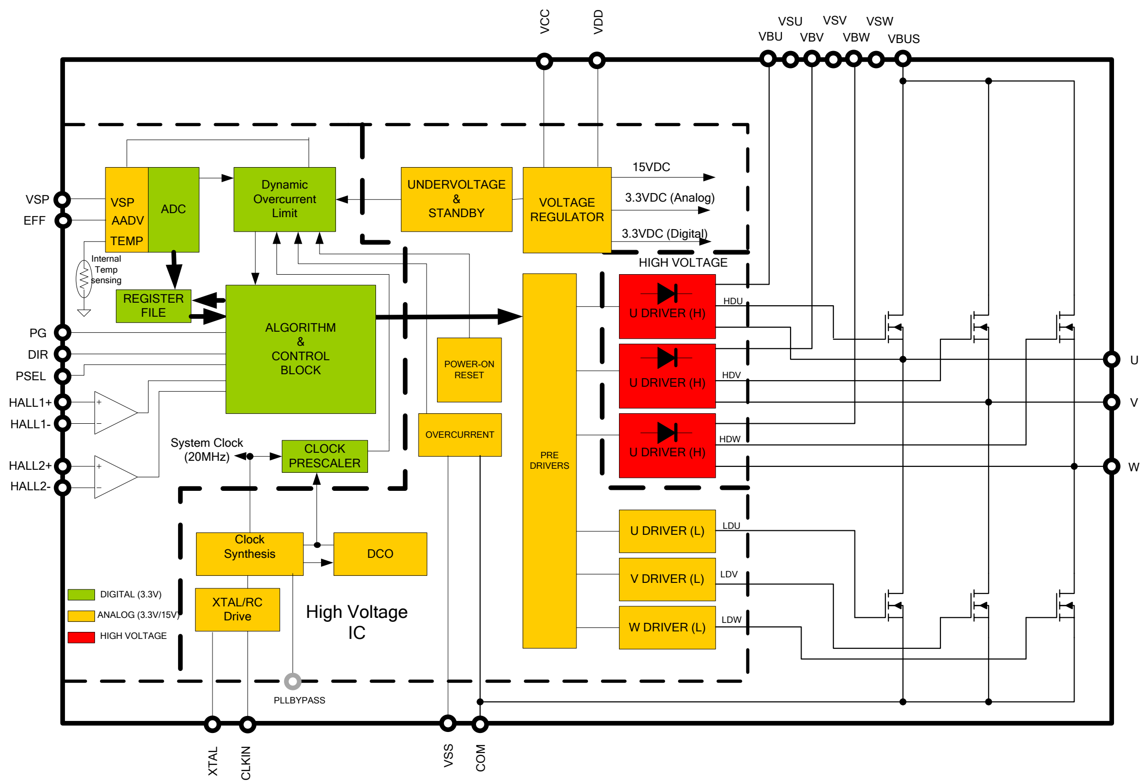


Figure 1 Simplified Block Diagram

Qualification Information†

Qualification Level		Industrial[††] (per JEDEC JESD 47) Stress Test ; Preconditioning, Temp Cycle, Autoclave, THB, HTSL, LTSL, IOL,
Moisture Sensitivity Level	PQFN	MSL3[†††] (per IPC/JEDEC J-STD-020) Floor Life Time ; 168 hours Conditions ; <30°C/60% RH Bake conditions ; 125 +5/-0°C, 24 hours minimum
ESD	Machine Model	Class B (per JEDEC Standard JESD22-A115) R1=0Ω, C1=200pF+/-10% Any part that passes after exposure to an ESD pulse of 100V, but fails after exposure to an ESD pulse of 150V.
	Human Body Model	Class 2 (per EIA/JEDEC standard EIA/JESD22-A114) R1=1500Ω+/-1%, C1=100pF+/-10% Any part that passes after exposure to an ESD pulse of 1500V, but fails after exposure to an ESD pulse of 2000V.
IC Latch-Up Test		Class I, Level A (per JESD78) Testing performed at room temperature ambient. The failure criteria as defined in table 1.
RoHS Compliant		Yes

† Qualification standards can be found at International Rectifier's web site http://www.irf.com/

†† Higher qualification ratings may be available should the user have such requirements. Please contact your International Rectifier sales representative for further information.

††† Higher MSL ratings may be available for the specific package types listed here. Please contact your International Rectifier sales representative for further information.

CLASS	TEST TYPE	TRIGGER POLARITY	CONDITION OF UNTESTED INPUT PINS	TEST TEMPERATURE (±2 °C)	V_{supply} CONDITION	TRIGGER TEST CONDITIONS [6]	FAILURE CRITERIA
I	I-TEST	POSITIVE see FIGURE	Max. Logic High [1]	Room temperature	Maximum operating voltage for each V_{supply} pin group per device specification	+(Inom + 100 mA) or 1.5X Inom, whichever is greater [3]	1.4 X Inom or Inom +10 mA whichever is greater [5]
			Min. Logic Low [1]				
		NEGATIVE see FIGURE	Max. Logic High [1]			-100 mA or -.5 X Inom, whichever is greater in magnitude [4]	
			Min. Logic Low [1]				
	V_{supply} OVER-VOLT-AGE TEST	see FIGURE	Max. Logic High [1]			1.5 X max. V_{supply} [2]	
			Min. Logic Low [1]				
II	I-TEST	POSITIVE see FIGURE	Max. Logic High [1]	Maximum ambient operating temperature	Maximum operating voltage for each V_{supply} pin group per device specification	+(Inom + 100 mA) or 1.5X Inom, whichever is greater [3]	
			Min. Logic Low [1]				
		NEGATIVE see FIGURE	Max. Logic High [1]			-100 mA or -.5 X Inom, whichever is greater in magnitude [4]	
			Min. Logic Low [1]				
	V_{supply} OVER-VOLT-AGE TEST	see FIGURE	Max. Logic High [1]			1.5 X max. V_{supply} [2]	
			Min. Logic Low [1]				

Table 1.

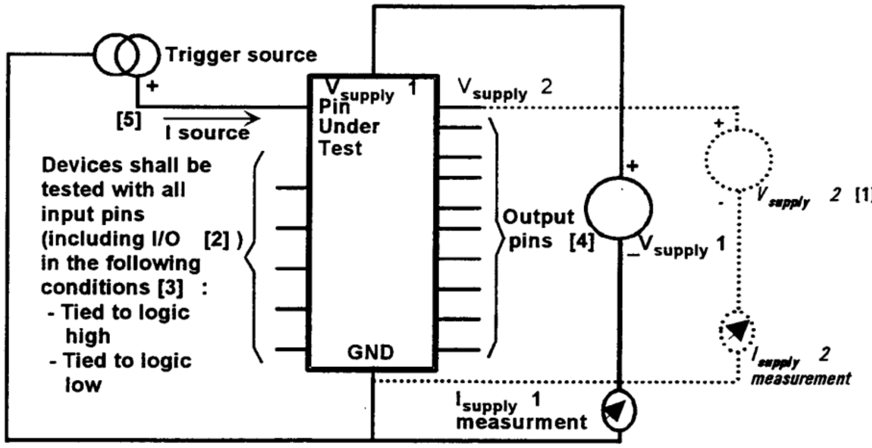


Figure 2.

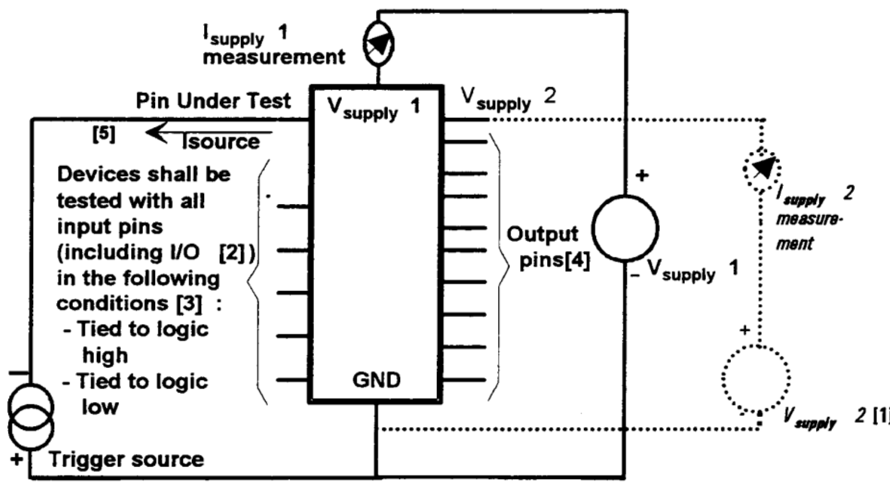


Figure 3.

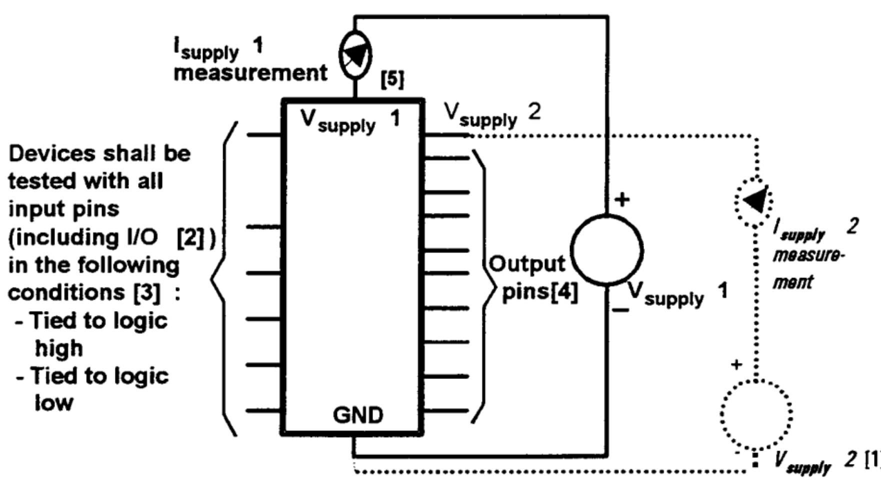


Figure 4.

IRDM983-025MB/-035MB Electrical Characteristics

Absolute Maximum Ratings

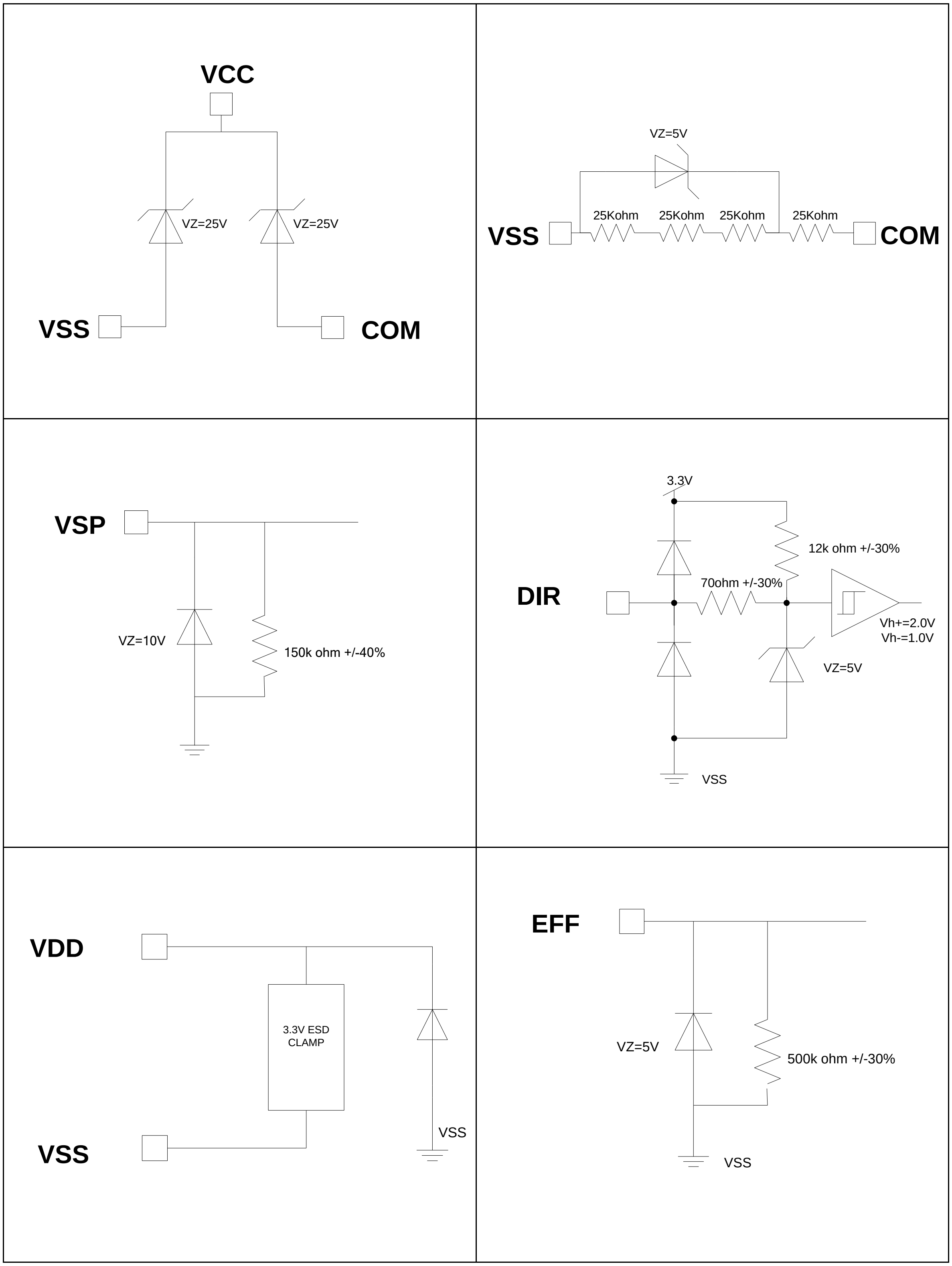
Absolute maximum ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are absolute voltages referenced to **VSS** unless otherwise stated in the table. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions.
Ta=25C, unless otherwise stated.

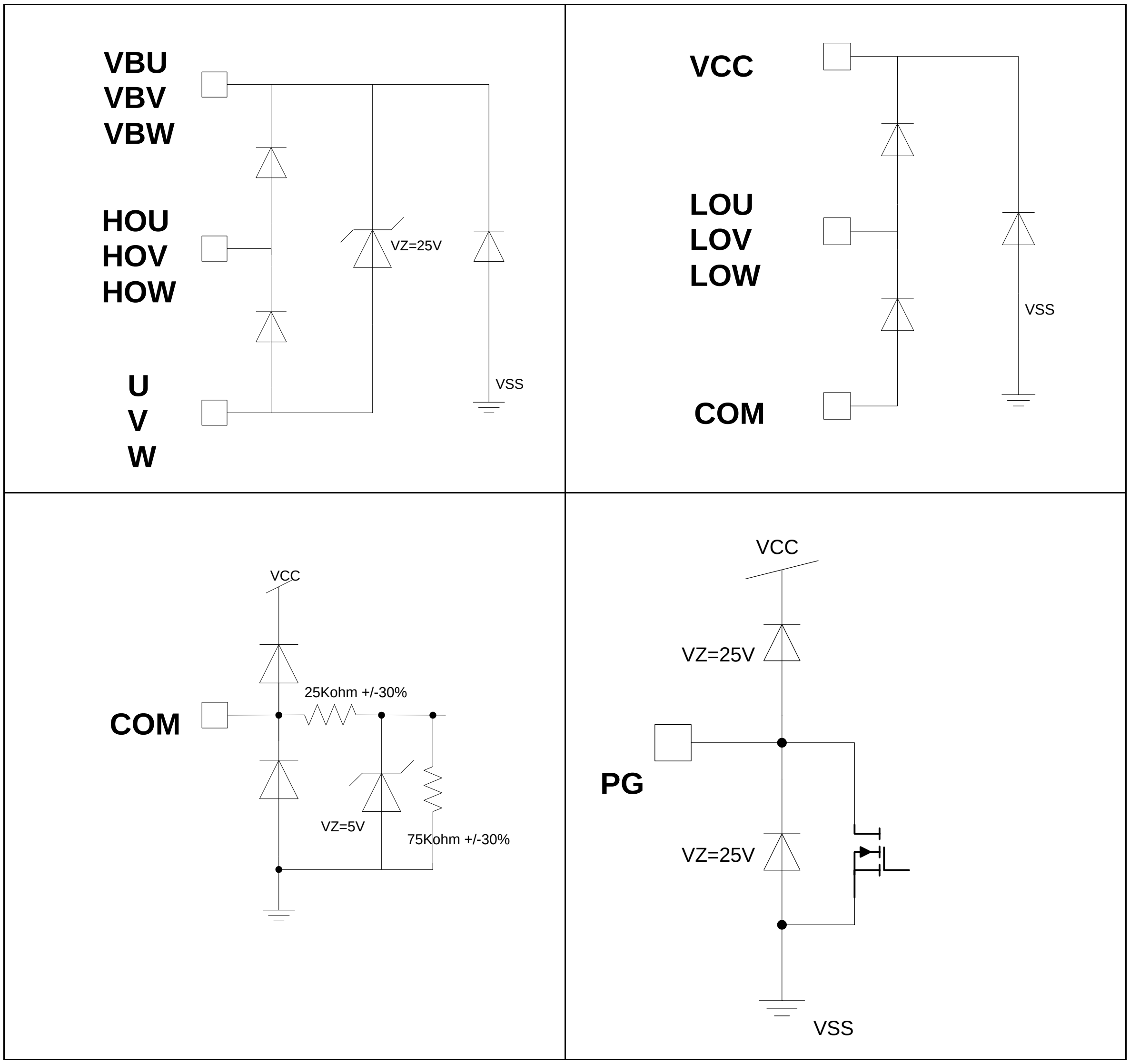
Symbol	Definition	Min.	Max.	Units	Condition
V_{ISO}	Isolation voltage	1500	-	Vrms	AC 1 minute
		1800	-		AC 1 second
DCBUS	DC bus voltage	-	500	V	IRDM983-025MB IRDM983-035MB
$DCBUS_{STAT}$	DC bus voltage for PWM off	-	600		IRDM983-025MB IRDM983-035MB VSP=0V, 1 minute, CO1=CO2[2)]
VBU, VBV, VBW	High-side floating absolute voltage	-0.3	525		
VSU, VSV, VSW	High-side floating supply offset voltage	VB - 25	VB + 0.3		
VCC	Low side power supply absolute voltage	-0.3	24		
ID	Drain current, IRDM983-035MB	-	3.9	A	Tc=25°C, Rth=2C/W
	Drain current, IRDM983-025MB	-	2.6		Tc=25°C, Rth=3C/W
I_{VDD}	VDD current capability	-	2	mA	TW=1ms
I_{VSP}	VSP input current	-	5		
COM	Power Ground	VCC - 24	VCC + 0.3	V	
V_{HCOM}	Hall Sensor input common mode voltage	-0.3	VDD		
V_{PG}	Open drain output motor evolution pulse	-0.3	VCC+0.3		
V_{VSP}	Analog input voltage VSP	-0.3	10.0		
V_{DIR} V_{EFF}	Direction, Efficiency curve pins input voltage	-0.3	VDD+0.3		
VDD	3.3V voltage regulator output	-0.3	3.6		No short to ground
PD	Package power dissipation @ Tc ≤ +100 °C[1)]	-	5	W	
TJ	Junction temperature[1)]	-	150	°C	
TS	Storage temperature[1)]	-55	150		
TL	Lead temperature (soldering, 10 seconds)[1)]	-	260		

1) Guarantee by design, not tested at manufacturing

2) Output capacitance between VB-VS and VS-COM are same within +/-1%

ESD structure




VBU
VBV
VBW
HOU
HOV
HOW
U
V
W
VZ=25V
VSS
VCC
LOU
LOV
LOW
COM
VSS
VCC
COM
25Kohm +/-30%
VZ=5V
75Kohm +/-30%
VCC
VZ=25V
PG
VZ=25V
VSS

Recommended Operating Conditions

For proper operation, the device should be used within the recommended conditions. All voltage parameters are absolute voltages referenced to **VSS** unless otherwise stated in the table.
The input/output logic timing diagram is shown in Fig. 1.
The VS and VSS offset rating are tested with all supplies biased at a 15 V (VCC) differential / 3.3V (VDD).
Power up and down sequences are not dependent on the order of VCC, DCBUS, and VSP for proper operation to start or stop.

Symbol	Definition	Min.	Typ	Max.	Units	Condition
V_U, V_V, V_W	PWM output motor voltage[1)]	100	320	450	V	IRDM983-025MB IRDM983-035MB
V_{PWMTR}	Transient PWM output motor voltage †[1)]	-50	0	500	V	50ns transient period
P_O	Output power[1)]	-	50	-	W	Fc=20kHz, DCBUS=300V, IO=140mArms, no heatsink, Ta=40C, IRDM983-025MB
		-	60	-		Fc=20kHz, DCBUS=300V, IO=200mArms, no heatsink, Ta=40C, IRDM983-035MB
VCC	Low side supply voltage	13.5[1)]	15	16.5[1)]	V	
V_{COM}	COM-VSS voltage	-5	0	5	V	
V_{HCOM}	Hall sensor input voltage COMMON MODE	0.6	-	2.9	V	
V_{DIR}, V_{EFF}	Direction, Efficiency curve selection input pin voltage	0	-	VDD	V	
V_{PG}	Open drain output motor evolution pulse	0	-	VCC	V	
V_{VSP}	VSP input voltage	0	-	9.8	V	
VDD	3.3V voltage regulator output	3.0	-	3.6	V	Io=2mA
VDDstby	3.3V voltage regulator output when in stand by[1)]	0	-	0.8	V	VSP<1,15V for more than 5 s, Cout=20pF
I_{VDD}	VDD current capability	-	-	2	mA	TW=1ms
C_{VDD}	Capacitor at VDD	2.2	-	22	uF	
FCRmax	Carrier frequency	23.3k	23.9k	24.5k	Hz	R_{CLKIN}=57.6KΩ, C_{CLKIN}=270pF F_{CLKIN}=38.99kHz
FCRtyp	Carrier frequency	18.1k	18.5k	18.9k	Hz	R_{CLKIN}=75KΩ, C_{CLKIN}=270pF F_{CLKIN}=30.31kHz
FCRmin	Carrier frequency	14.5k	14.7k	15.0k	Hz	R_{CLKIN}=95.3KΩ, C_{CLKIN}=270pF F_{CLKIN}=24.07kHz
R_{CLKIN}	Resistor for RC oscillator[2)]	-	75K 39.2K	-	Ω	R=75kohm with C=270pF, C_{PCB}=0pF Fc=18.83kHz R=75kohm with C=270pF, C_{PCB}=5pF Fc=18.50kHz R=39.2kohm with C=470pF, C_{PCB}=0pF Fc=20.75kHz R=39.2kohm with C=470pF, C_{PCB}=5pF Fc=20.54kHz
C_{CLKIN}	Capacitor for RC oscillator[2)]	-	270 470	-	pF	
TA	Ambient temperature[1)]	-40		125	°C	

†Operational for transient negative VS of - 50 V with a 50 ns pulse width is guaranteed by design. Refer to the Application Information section of this datasheet for more details.

1) Guarantee by design, not tested at manufacturing

2) Carrier Frequency is calculated by the following.

$$FC=1/(((R+50)\times(C+5\times10^{-12}+C_{PCB})+900\times10^{-9})\times2.466)$$

C_{PCB} : Board layout capacitance

Static Electrical Characteristics

(V_{CC}-COM) = (V_B-V_S) = 15 V. TA = 25°C unless otherwise specified. The VSP and IIN parameters are referenced to V_{SS} and are applicable to all six channels. The VO and IO parameters are referenced to respective V_S and COM and are applicable to the respective output leads HO or LO. The V_{CCUV} parameters are referenced to V_{SS}. The V_{BSUV} parameters are referenced to V_S.

Symbol	Definition	Min	Typ	Max	Units	Test Conditions
IDSS	DC bus to COM leakage current, IRDM983-035MB	-	70	200	uA	DCBUS=500V, Tj=25C,per device
	DC bus to COM leakage current, IRDM983-025MB	-	50	100		
VF	MOSFET body diode voltage, IRDM983-025MB	-		1.0[2)]		IF=1A
	MOSFET body diode voltage, IRDM983-035MB	-		1.0[2)]		
VDD	VDD voltage	3.0	3.3	3.6		Io=2mA
VIH	Logic “1” input voltage	2.5	-	-		
VIL	Logic “0” input voltage	-	-	0.8		
VSPstbylow	Active to Standby mode VSP input negative going thresholds	1.05	1.15	1.25		
VSPstbyhigh	Standby to Active mode VSP input positive going thresholds	1.3	1.4	1.5	V	
VSPstbyhys	Standby mode VSP hysteresis	0.1	0.25	0.4		
VSPmin	VSP 0%duty	1.7	1.9	2.1		
VSPmax	VSP 100%duty	4.8	5.0	5.2		
VSP6step enter	VSP voltage that ensures enter in 6 step mode	8.0	8.8	9.68		500 ms continuously above threshold
VSP6step exit	VSP voltage that ensures exit from 6 step mode	8.0	8.8	9.68		200 ms continuously below threshold
V_{HCOM}	Hall sensor input voltage COMMON MODE	0.6	2	2.9		
V_{HDIF}	Hall sensor input voltage DIFFERENTIAL MODE	0.03	0.5	2.5		
V_{NOG}	Hall sensor input OP amp open loop gain[1)]	60	-	80	dB	Ta=-40 – 125C
V_{HOO}	Hall sensor input OP amp offset[1)]	-	1	-	mV	
V_{IHSTH}	Hall sensor input Schmitt Trigger input buffer hysteresis[1)]	-	1	-		
V_{HST+}	Hall sensor input Digital Schmitt Trigger input buffer positive going voltage[1)]	-	2	-		
V_{HST-}	Hall sensor input Digital Schmitt Trigger input buffer negative going voltage[1)]	-	1	-		
$V_{CLKIN,TH+}$	CLKIN positive going threshold	2.5	-	-		
$V_{CLKIN,TH-}$	CLKIN negative going threshold	-	-	0.8	V	
$V_{CC,UVTH+}$	V_{CC} supply undervoltage positive going Threshold	8	8.9	9.8		
$V_{CC,UVTH-}$	V_{CC} supply undervoltage negative going Threshold	7.4	8.2	9		
$V_{CC,UVHYS}$	V_{CC} supply undervoltage hysteresis	0.3	0.7	-		
$V_{BS,UVTH+}$	V_{BS} supply undervoltage positive going Threshold	8	8.9	9.8		
$V_{BS,\ UVTH-}$	V_{BS} supply undervoltage negative going Threshold	7.4	8.2	9	V	
$V_{BS,UVHYS}$	V_{BS} supply undervoltage hysteresis	0.3	0.7	-		

V_{ILIM1}	Current Limit Input voltage 1 [3]	450	520	590	mV	Tc<92C (+/-12C)
V_{ILIM2}	Current Limit Input voltage 2 [3]	300	375	450		Tc=92<96C (+/-12C)
V_{ILIM3}	Current Limit Input voltage 3 [3]	200	250	300		Tc=96<100C(+/-12C)
$V_{ROCKILIM}$	Current Limit input voltage at Rotor Lock	200	250	300	°C	
$V_{ILIMHYS}$	Current Limit Input voltage hysteresis	-	60	-		
T_{OT+}	Positive going over-temperature limit	88	100	112		
T_{OT-}	Negative going over-temperature limit	68	80	92		
TAC	Temp sensor absolute accuracy	0	-	12		
TES	Temp sensor resolution[1]	0	-	3.25		
ICC	Vcc current	-	13	24	mA	
ICC_{STDBY}	Vcc current at standby	-	0.10	0.20		
I_{VDD}	3.3V output current	-	-	2		
C_{VDD}	External capacitor for VDD[1]	2.2	-	22	uF	
PWM_{RES}	PWM pulse width resolution	-	500	-	Counts	100ns resolution
MOD_{RESINT}	Internal modulator amplitude resolution[1]	-	1686	-	kHz	
Fc	PWM carrier frequency	19.6	20	20.4		CLKIN=32.768kHz
FXTAL	XTAL pin frequency[1]	29.6	30.3	30.9		R=75kohm, C=270pF
		32.2	32.8	33.5		R=40.2kohm, C=470pF
RBS	Ron internal bootstrap diode	-	220	-	Ω	
PD_{STBY}	Standby power dissipation	-	1.5	3.0	mW	VSP<1.15V, DCBUS=0V
I_{DRV+}	Internal driver gate drive sourcing current[1]		6		mA	V_{DRV} =0 V,PW ≤10 µs
I_{DRV-}	Internal driver gate drive sinking current[1]	-	160	-		V_{DRV} =15 V, PW ≤10 µs
RON_{SPDFBK}	Ron of SPDFBK pin	-	50	100	Ω	
Rthj-c	Thermal resistance, junction to case[1]	-	3	-	°C /W	IRDM983-025MB
		-	2	-		IRDM983-035MB

1) Guaranteed by design, not tested at manufacturing
2) Tested at wafer probe
3) $V_{ILIM1,2,3}$ thresholds are tested at 25 degC. Temperature range is based on characterization only.

Dynamic Electrical Characteristics

V_{CC}= V_B = 15 V, V_S = V_{SS} = COM, T_A = 25°C, and C_L = 1000 pF unless otherwise specified.

Symbol	Definition	Min	Typ	Max	Units	Test Conditions
I_{CSC}	Short Circuit Drain Current[1)]	-	3	-	A	IRDM983-025MB, T_J=25°C, t_{SC}<20µs V^+= 320V, V_{CC}=15V
		-	5	-		IRDM983-035MB, T_J=25°C, t_{SC}<20µs V^+= 320V, V_{CC}=15V
SCSOA	Short Circuit duration period[1)]	20000	-	-	ns	V^+= 300V(IRDM983-025MB,-35MB), V_{CC}=+15V to 0V, line to line short
t_{RR}	Reverse recovery time [1)]	-	80	-	ns	ID=1A, di/dt=100A/us
t_{ILIM}	ILIM to PWM current limit propagation delay	-	3000	-	ns	C_{LOAD} = 1nF, F_{CLKIN} =32.768kHz
$t_{ILIMFIL}$	ILIM filter time[1)]	500	1000	1700	ns	VILIM=2V, Ta=25C
		400	800	1400		VILIM=2V, Ta=125C
		600	1200	2000		VILIM=2V, Ta=-40C
t_{HFILA}	Hall differential input analog filter[1)]	-	1500	-		
t_{HFILD}	Hall input digital filter delay[1)]	-	2500	-		F_{CLKIN} =32.768kHz
$t_{HALLSAT}$	HALL input response time from saturation[1)]	-	5000	-		
t_{HALLPG}	HALL input to PG output propagation delay	-	5000	-		F_{CLKIN} =32.768kHz
t_{VSPACT}	VSP standby to PWM active time	14.0	17.5	22.0	ms	CVDD=2.2uF, VSP=0→5.4V, F_{CLKIN} =32.768kHz
$T_{VSPONDELAY}$	VSP active to PWM duty active	2.0	3.5	5.0		VSP from 1.8V to 2.6V, F_{CLKIN} =32.768kHz
$t_{VDDHOLD}$	VDD hold time at standby[1)]	4.9	5.0	5.1	S	CVDD=2.2uF, VSP=2→0V, F_{CLKIN} =32.768kHz
$t_{RLOCKDETECT}$	Rotor Lock detect time[1)]	4.9	5	5.1		VSP>2.1V, |Elec freq|<3Hz, F_{CLKIN} =32.768kHz
DT	Deadtime	-	1000	-	ns	F_{CLKIN} =32.768kHz
PW_{HIN}	Internal high side minimum pulse width	-	400	-		Not a final output of a part , F_{CLKIN} =32.768kHz
PW_{LIN}	Internal low side minimum pulse width	-	100	-		Not a final output of a part , F_{CLKIN} =32.768kHz
SPD_{OVER}	Over speed[1)]	-	200	-	Hz	F_{CLKIN} =32.768kHz
SPD_{PWMCHG}	Block commutation to sine PWM change speed[1)]	-	3	-		1 consecutive electrical angle update period, F_{CLKIN} =32.768kHz
SPD_{EFF1}	EFF bending point 1 speed[1)]	-	33.33	-		F_{CLKIN} =32.768kHz
SPD_{EFF2}	EFF bending point 2 speed[1)]	-	83.33	-		F_{CLKIN} =32.768kHz

1) Guaranteed by design, not tested at manufacturing

Figures of Input Circuit and Table

The following Figure shows the interconnect bonding among the HVIC and MOSFETs within a package.

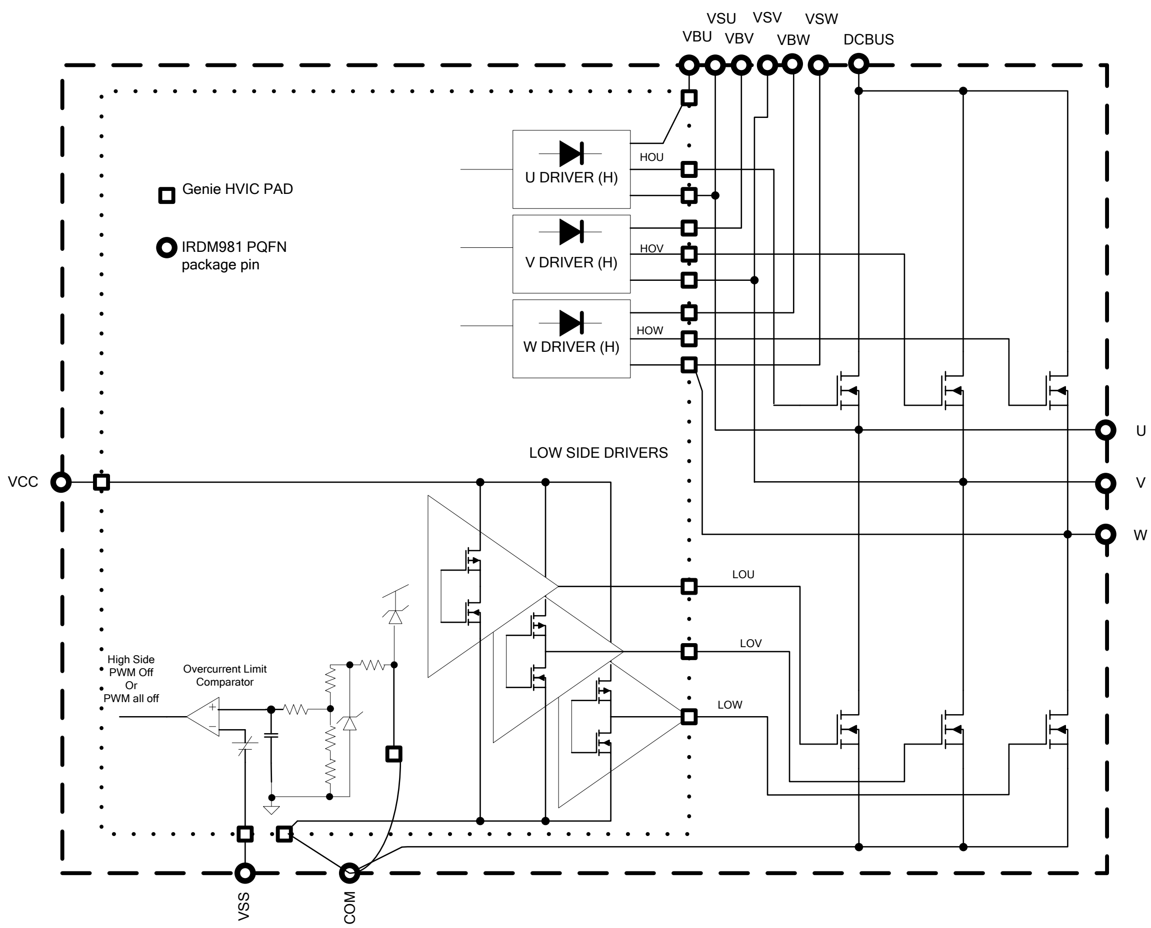


Figure 11 Connection diagram of VSS/COM and power pins/pads

The following Figures show the VSP input mapping, the Hall sensor input circuit, and the ISENSE pin input filter circuit.

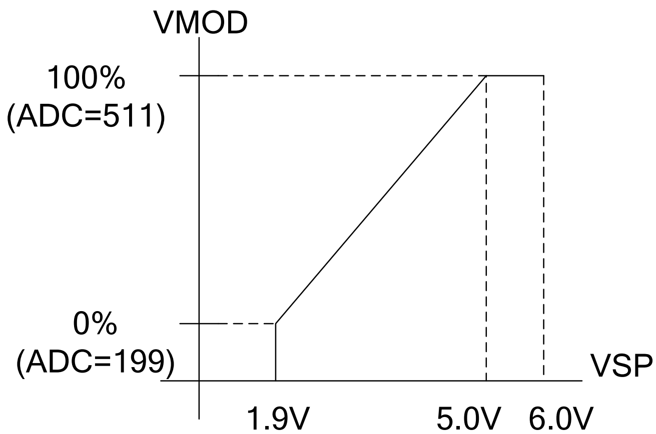


Figure 12 VSP Range and Thresholds

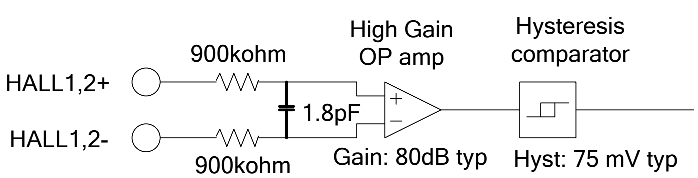


Figure 13 Hall sensor input circuit

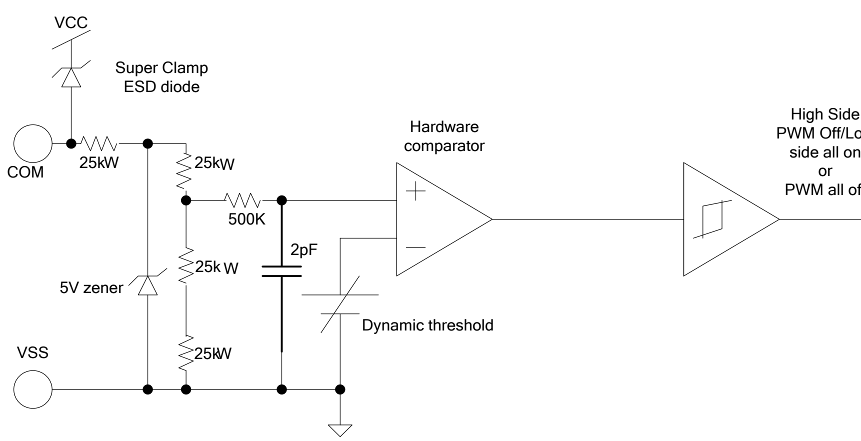


Figure 14 COM pin current limit comparator and analog filter

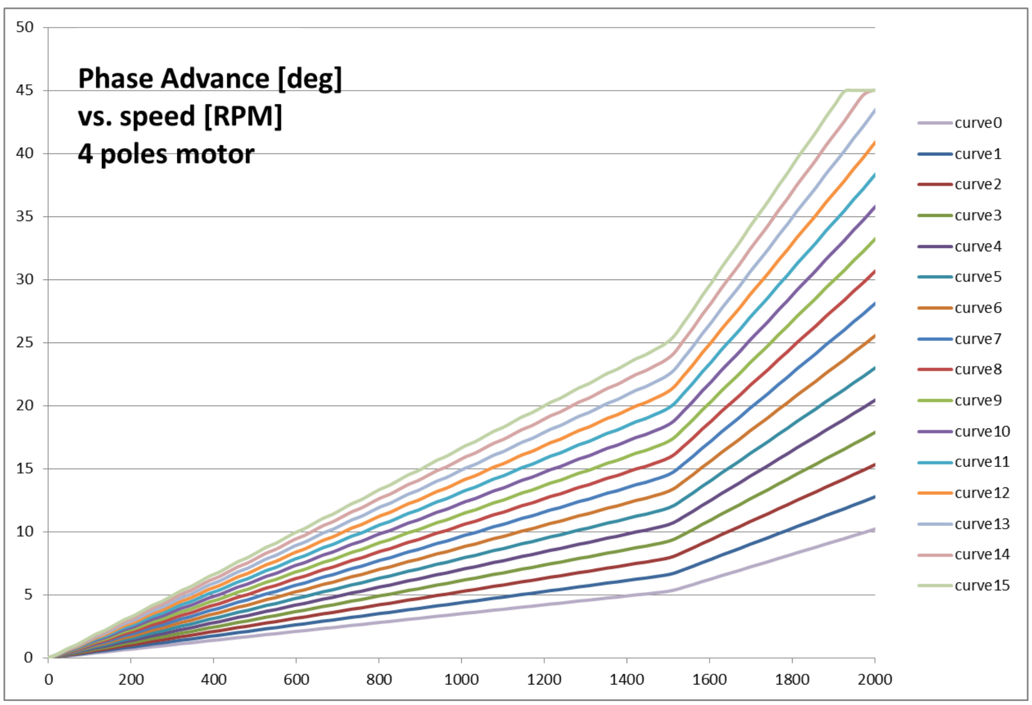
Load Curves

The following Table shows EFF pin mapping between input voltage and the advanced angle in degree per 50Hz of fundamental electrical frequency. Phase advance is by design clamped to be lower than 45 degrees at every frequency. At frequencies above 100 Hz the advancement is constant and it is kept to the same value at 100Hz.

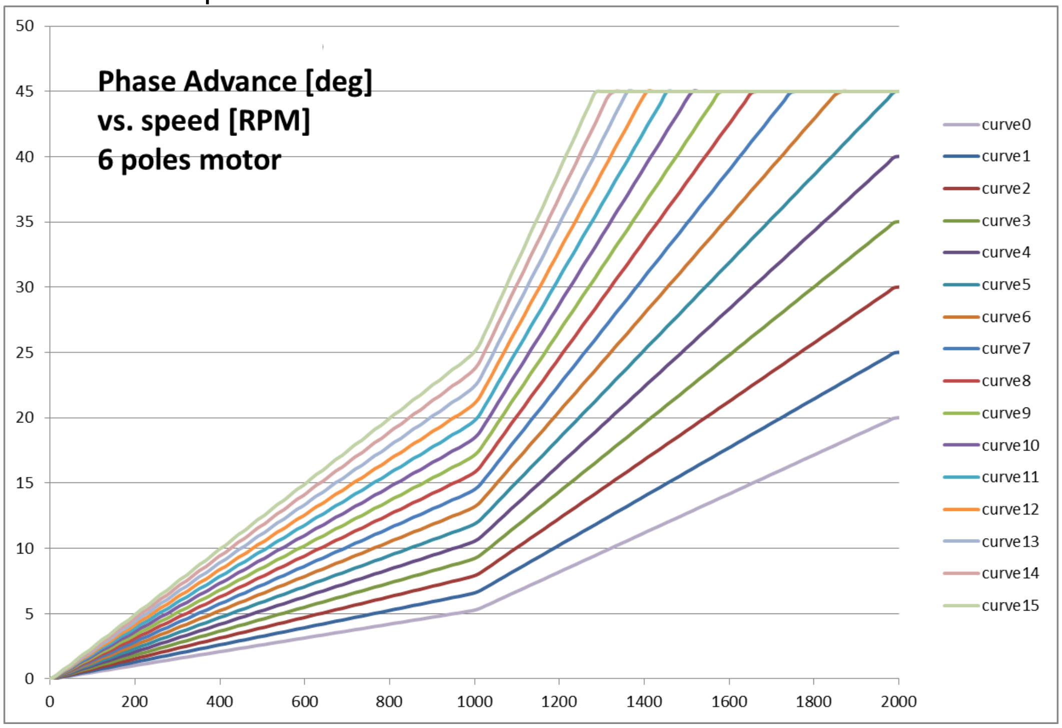
Select	Degree/50Hz	Frequency [Hz] @ advance=45deg	EFF input	EFF digital input
15	25.49	64.22	3.094V – 3.300V	152
14	24.15	65.75	2.888V – 3.087V	144
13	22.81	68.04	2.681V – 2.881V	136
12	21.47	70.34	2.475V – 2.675V	128
11	20.12	72.63	2.269V – 2.469V	120
10	18.78	75.69	2.063V – 2.262V	112
9	17.44	78.75	1.856V – 2.056V	104
8	16.10	81.80	1.650V – 1.850V	96
7	14.76	87.16	1.444V – 1.644V	88
6	13.42	92.51	1.238V – 1.437V	80
5	12.07	99.39	1.031V – 1.231V	72
4	10.73	Advance=40deg above 100Hz	0.825V – 1.025V	64
3	9.39	Advance=35deg above 100Hz	0.619V – 0.819V	56
2	8.05	Advance=30deg above 100Hz	0.413V – 0.612V	48
1	6.71	Advance=25deg above 100Hz	0.206V – 0.406V	40
Default = 0	5.37	Advance=20deg above 100Hz	0.000V – 0.200V	32

Table 2a EFF Parameters Selection

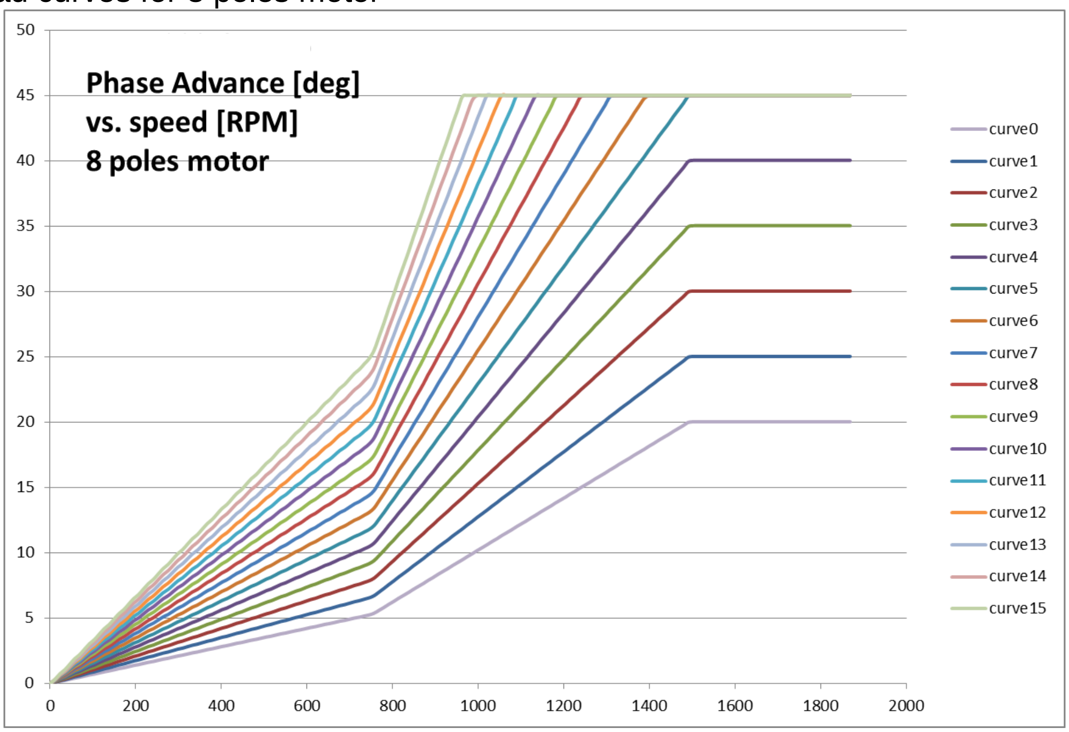
Load curves for 4 poles motor



Load curves for 6 poles motor



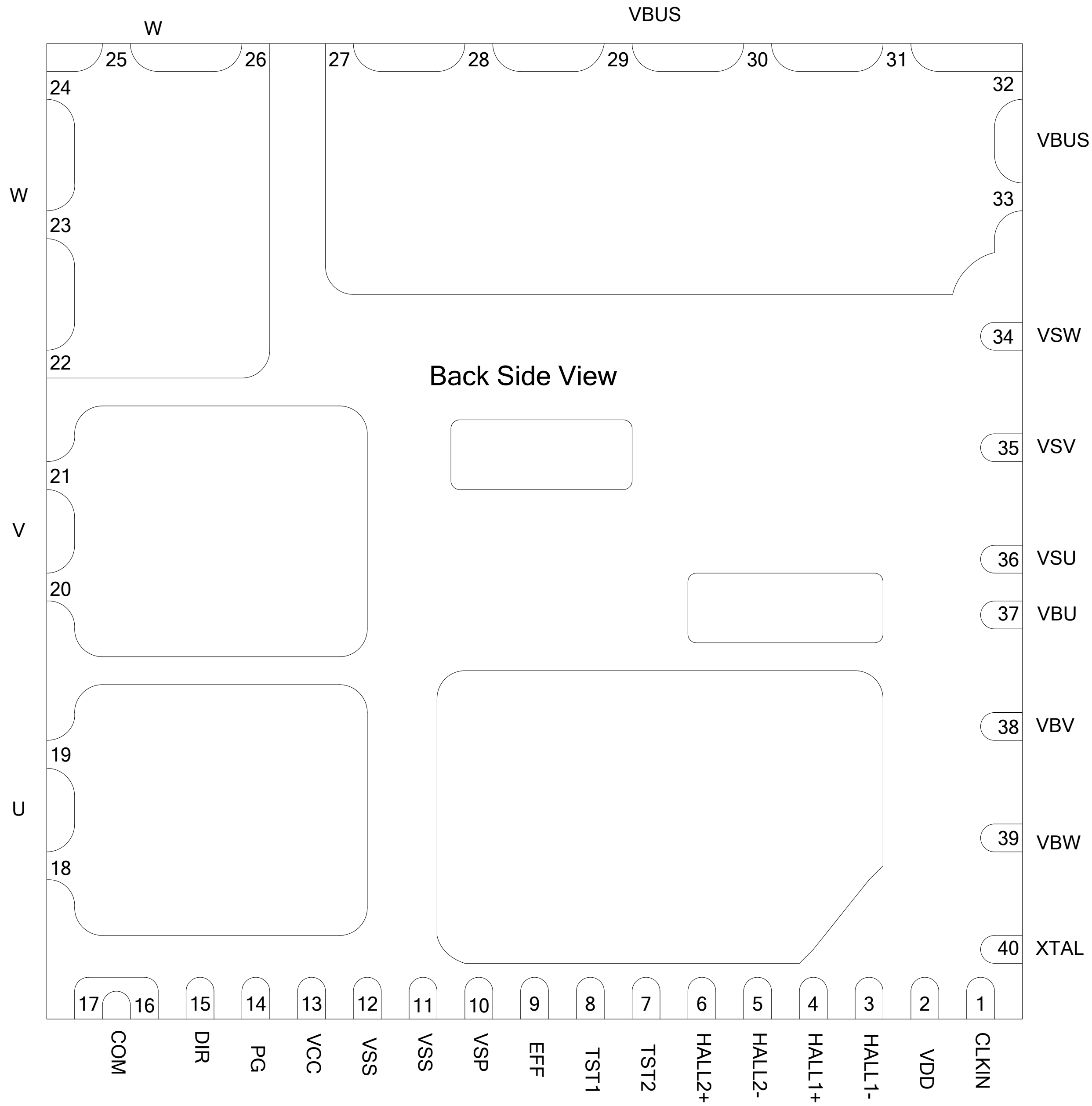
Load curves for 8 poles motor



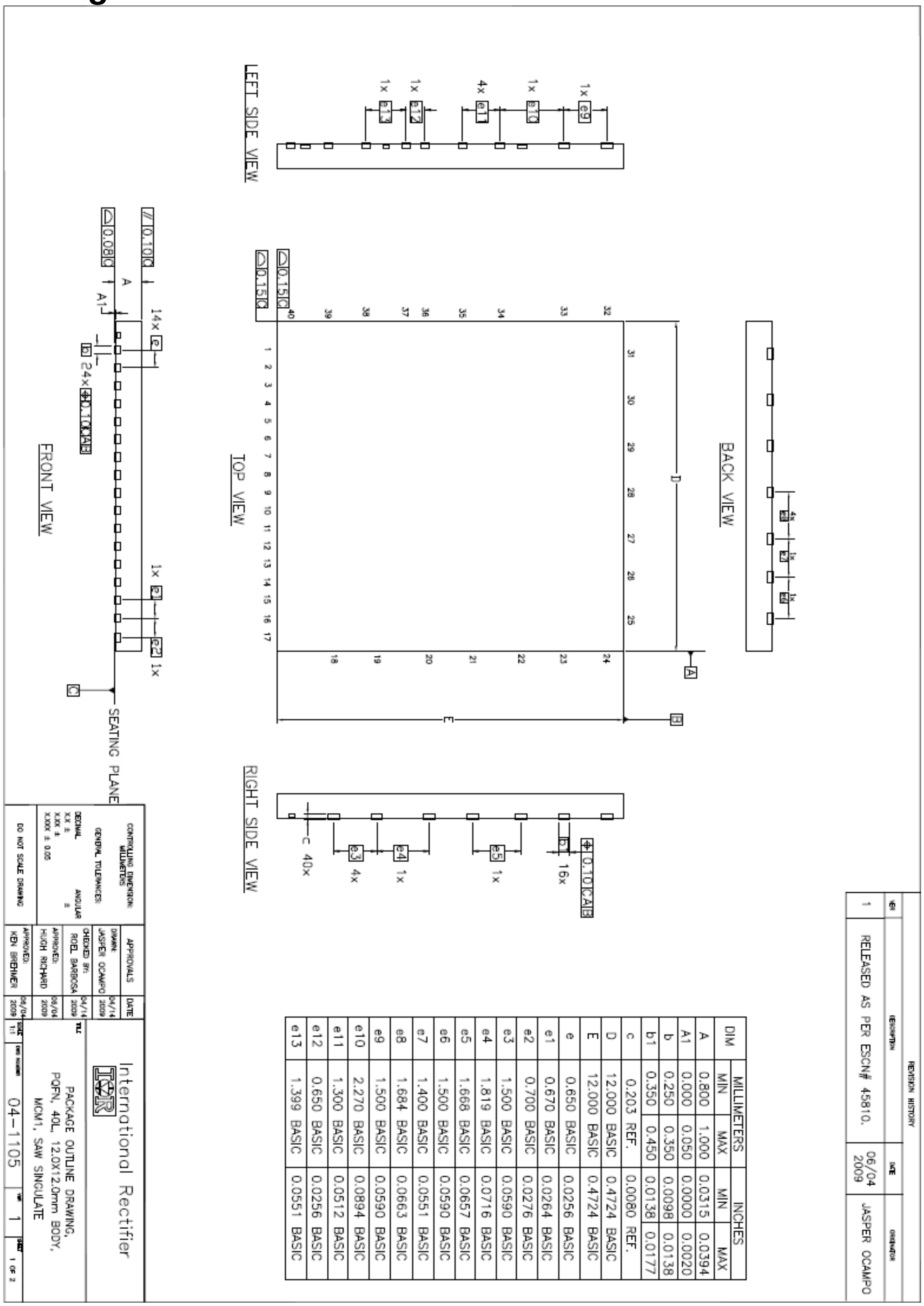
Lead Definitions

Symbol	Pin #	Description
VSP	10	Voltage Set Point analog input. Provides the value of the PWM modulation index to the controller.
PG	14	Provides speed feedback to through pulses per revolution. It is an open drain output 15V tolerant. Output is a square wave of a 3 pulses per electrical cycle of fundamental frequency
DIR	15	Motor Direction Input (internally pulled up high = U→V→W)
EFF	9	Load curve selection parameter Input for efficiency improvement
XTAL	40	Clock buffer output
CLKIN	1	Clock buffer input
VSS	11	Logic ground
COM	16,17	Analog input ITRIP and Power Ground and Low side MOSFET cource
VCC	13	15V supply voltage
HALL1+	4	Hall sensor 1 positive input
HALL1-	3	Hall sensor 1 negative input
HALL2+	6	Hall sensor 2 positive input
HALL2-	5	Hall sensor 2 negative input
TST1	8	Pin for factory testing – connect to VDD in normal application
TST2	7	Pin for factory testing – connect to VSS in normal application
VDD	2	3.3V output
U	18,19	U phase output
V	20,21	V phase output
W	22,23,24, 25,26	W phase output
VBU	37	Phase U High side Bootstrap capacitor positive
VBV	38	Phase V High side Bootstrap capacitor positive
VBW	39	Phase W High side Bootstrap capacitor positive
VSU	36	Phase U High side Bootstrap capacitor negative
VSV	35	Phase V High side Bootstrap capacitor negative
VSW	34	Phase W High side Bootstrap capacitor negative
DCBUS	27,28,29, 30,31,32, 33	DC Bus voltage

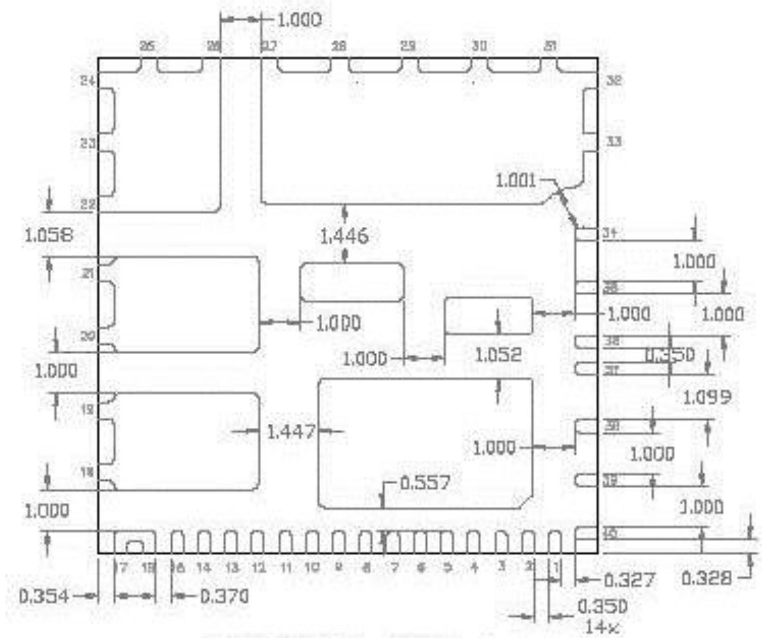
Lead Assignments



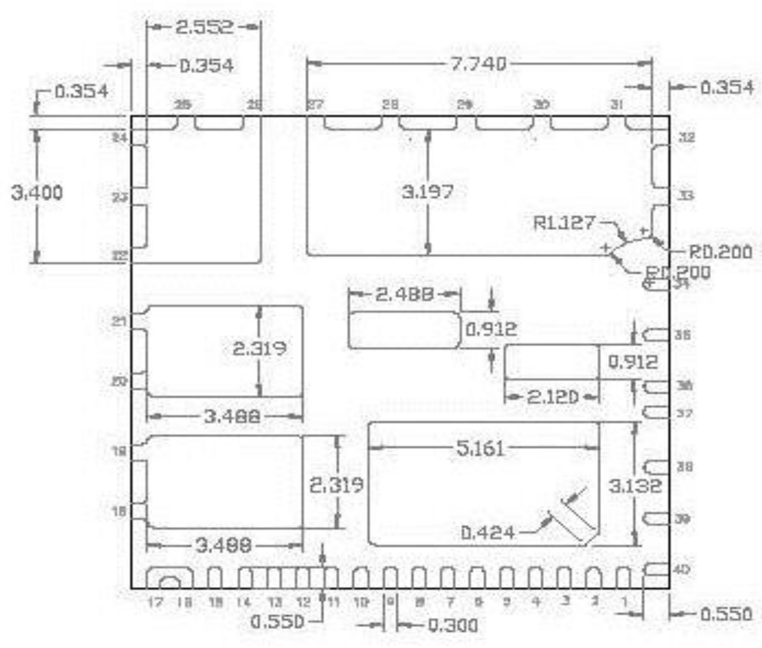
Package Outline



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	0.800	1.000	0.0315	0.0394
A1	0.000	0.050	0.0000	0.0020
b	0.250	0.350	0.0098	0.0138
b1	0.350	0.450	0.0138	0.0177
c	0.203 REF.		0.0080 REF.	
D	12.000 BASIC		0.4724 BASIC	
E	12.000 BASIC		0.4724 BASIC	
e	0.650 BASIC		0.0256 BASIC	
e1	0.670 BASIC		0.0264 BASIC	
e2	0.700 BASIC		0.0276 BASIC	
e3	1.500 BASIC		0.0590 BASIC	
e4	1.819 BASIC		0.0716 BASIC	
e5	1.668 BASIC		0.0657 BASIC	
e6	1.500 BASIC		0.0590 BASIC	
e7	1.400 BASIC		0.0551 BASIC	
e8	1.684 BASIC		0.0663 BASIC	
e9	1.500 BASIC		0.0590 BASIC	
e10	2.270 BASIC		0.0894 BASIC	
e11	1.300 BASIC		0.0512 BASIC	
e12	0.650 BASIC		0.0256 BASIC	
e13	1.399 BASIC		0.0551 BASIC	



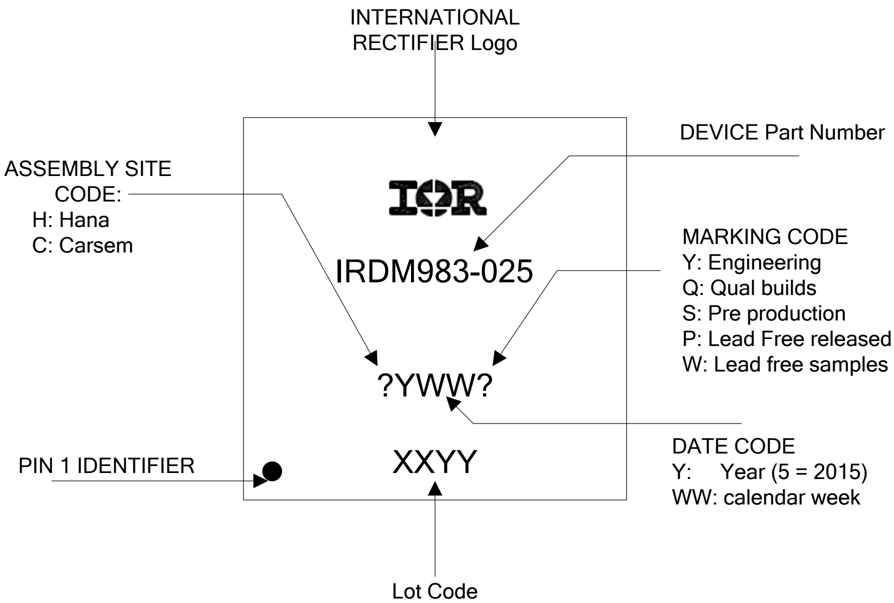
BOTTOM VIEW– DETAIL 1



BOTTOM VIEW– DETAIL 2

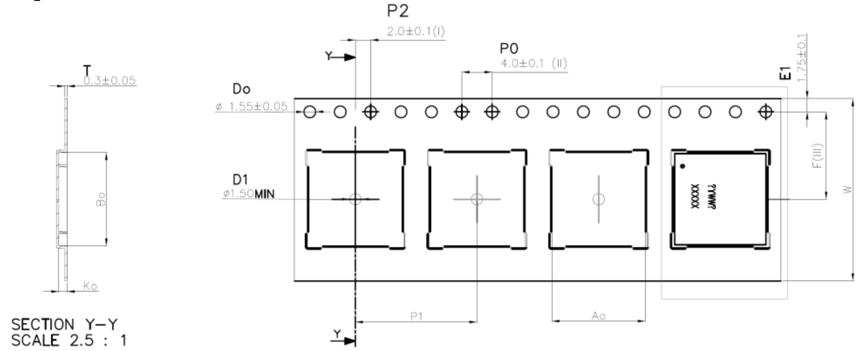
Dimension in mm^2

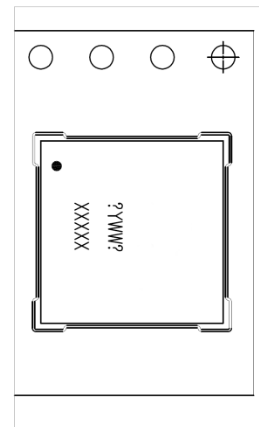
Package Marking



Part number	Internal MOSFET
IRDM983-025MB	500V 2A
IRDM983-035MB	500V 3A

Tape and Reel Details

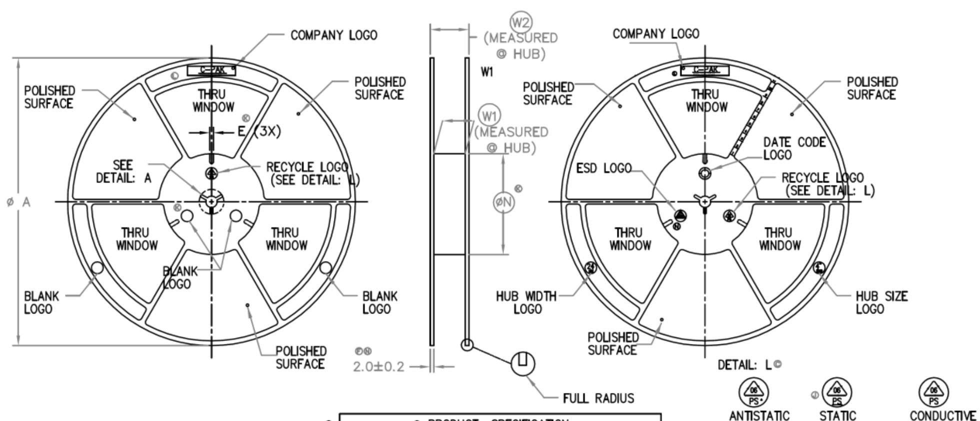


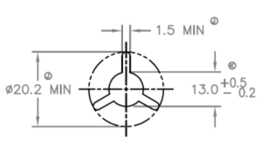


Ao	12.3 +/− 0.1
Bo	12.3 +/− 0.1
Ko	1.10 +/− 0.1
F	11.50 +/− 0.1
P1	16.00 +/− 0.1
W	24.00 +/− 0.3

(I) Measured from centerline of sprocket hole to centerline of pocket.
(II) Cumulative tolerance of 10 sprocket holes is ± 0.20 .
(III) Measured from centerline of sprocket hole to centerline of pocket.
(IV) Other material available.

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED.





ARBOR HOLE
DETAIL: A
SCALE 3:1

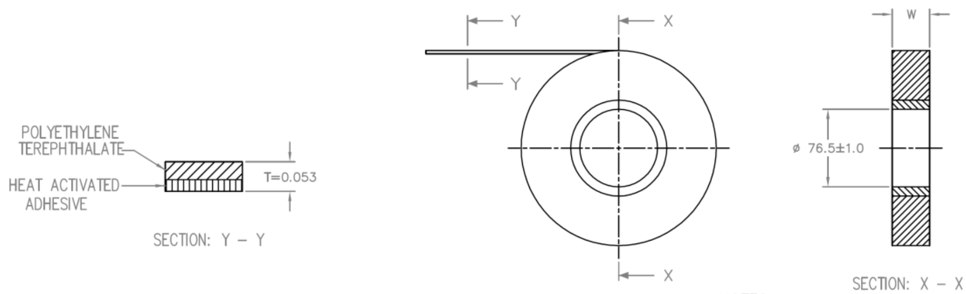
PRODUCT SPECIFICATION

TAPE WIDTH	ø A ± 2.0	ø N ± 2.0	W1	W2 (MAX)	E (MIN)
08MM	330	100	8.4 +1.5 −0.0	14.4	2.5
12MM	330	100	12.4 +2.0 −0.0	18.4	2.5
16MM	330	100	16.4 +2.0 −0.0	22.4	2.5
24MM	330	100	24.4 +2.0 −0.0	30.4	2.5
32MM	330	100	32.4 +2.0 −0.0	38.4	2.5

NOTES:
1. GENERIC PRODUCT.
2. FOR PRODUCT DRAWING ONLY.
3. SUNBLAST ALL SURFACE UNLESS OTHERWISE STATED.
4. MOLD 2

SURFACE RESISTIVITY

LEGEND	SR RANGE	TYPE	COLOUR
A	BELOW 10^{12}	ANTISTATIC	ALL TYPES
B	10^{6} TO 10^{11}	STATIC DISSIPATIVE	BLACK ONLY
C	10^{5} & BELOW 10^{5}	CONDUCTIVE (GENERIC)	BLACK ONLY
D	10^{5} TO 10^{9}	CONDUCTIVE (CUSTOM)	BLACK ONLY
E	BELOW 10^{12}	COATED ANTISTATIC	ALL COLOR



NOTES:

1. THICKNESS: 0.048–0.058 mm.
2. STANDARD LENGTH: 300 m
3. TENSILE STRENGTH: 7.7 kg/mm sq.
4. ELONGATION: 120%
5. SURFACE RESISTIVITY: 10^{11} ohms/SQ. MAX (STATIC DISSIPATIVE)
6. PEEL STRENGTH CONFORMS TO EIA SPEC. 55±25g
7. LUMINOUS TRANSMITTANCE: 91%
8. HAZE: 50%
9. OTHER COVER TAPE WIDTH REFER TO W14.08–04

TABLE 2:

STANDARD COVER TAPE WIDTH (W ± 0.1)	CARRIER TAPE WIDTH
5.3, 5.4	8
9.2, 9.3	12
13.3	16
21.0, 21.3	24
25.5	32
37.5	44
49.5	56

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED.

Soldering temperature profile

The following soldering temperature profile is recommended. Any temperature which may exceed those indicated below is not recommended and may cause a permanent damage to the physical component such as deformation.

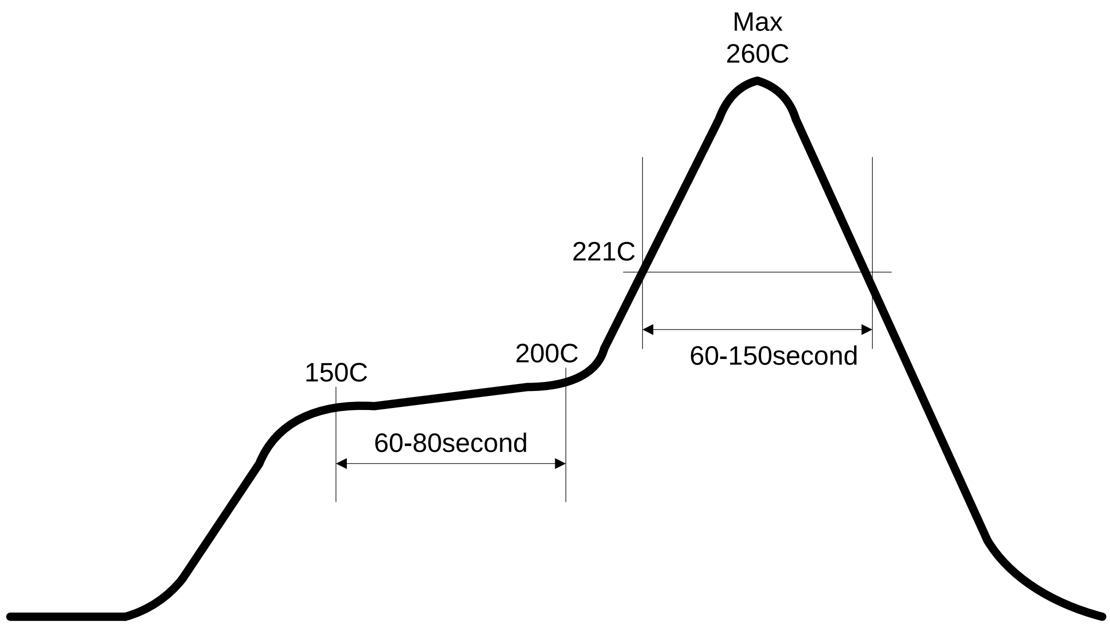


Figure 13 Recommended soldering temperature profile

Condition	Value	Remark
Temperature rise rate	3°C	
Temperature fall rate	6°C	
Number of reflow	2	
Manual soldering temperature	260°C	
Manual soldering time	10 second	

Table 3 Recommended soldering reflow condition

Edition 2016-08-19

Published by
Infineon Technologies AG
81726 München, Germany

Do you have a question about this document?
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Document reference