MITSUBISHI ELECTRIC

<HVIC>

M81775FP

600V HIGH VOLTAGE THREE PHASE BRIDGE DRIVER

DESCRIPTION

M81775FP is high voltage Power MOSFET and IGBT module driver for THREE PHASE bridge applications.

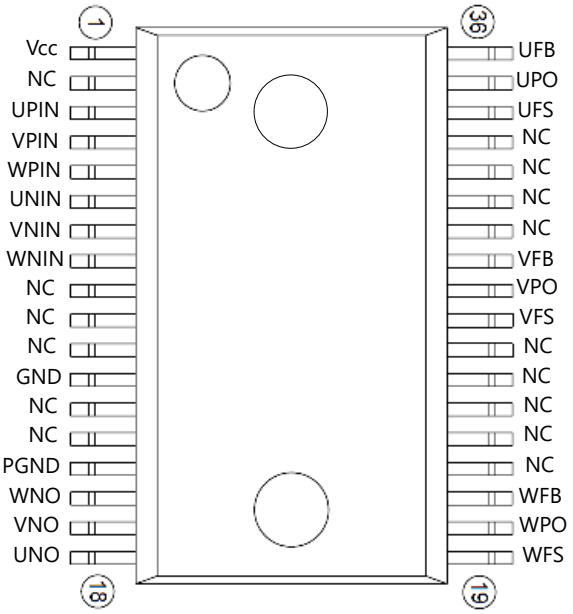
FEATURES

- ●Floating Supply Voltage.....600V
- ●Output Current .....+200mA/-500mA (typ)
- ●3Phase Bridge Driver
- ●Under Voltage (UV) Lockout
- ●36Pin SSOP Package

APPLICATIONS

MOSFET and IGBT module driver for refrigerator, air-conditioner,washing machine, AC-servomotor, inverter and general purposes.

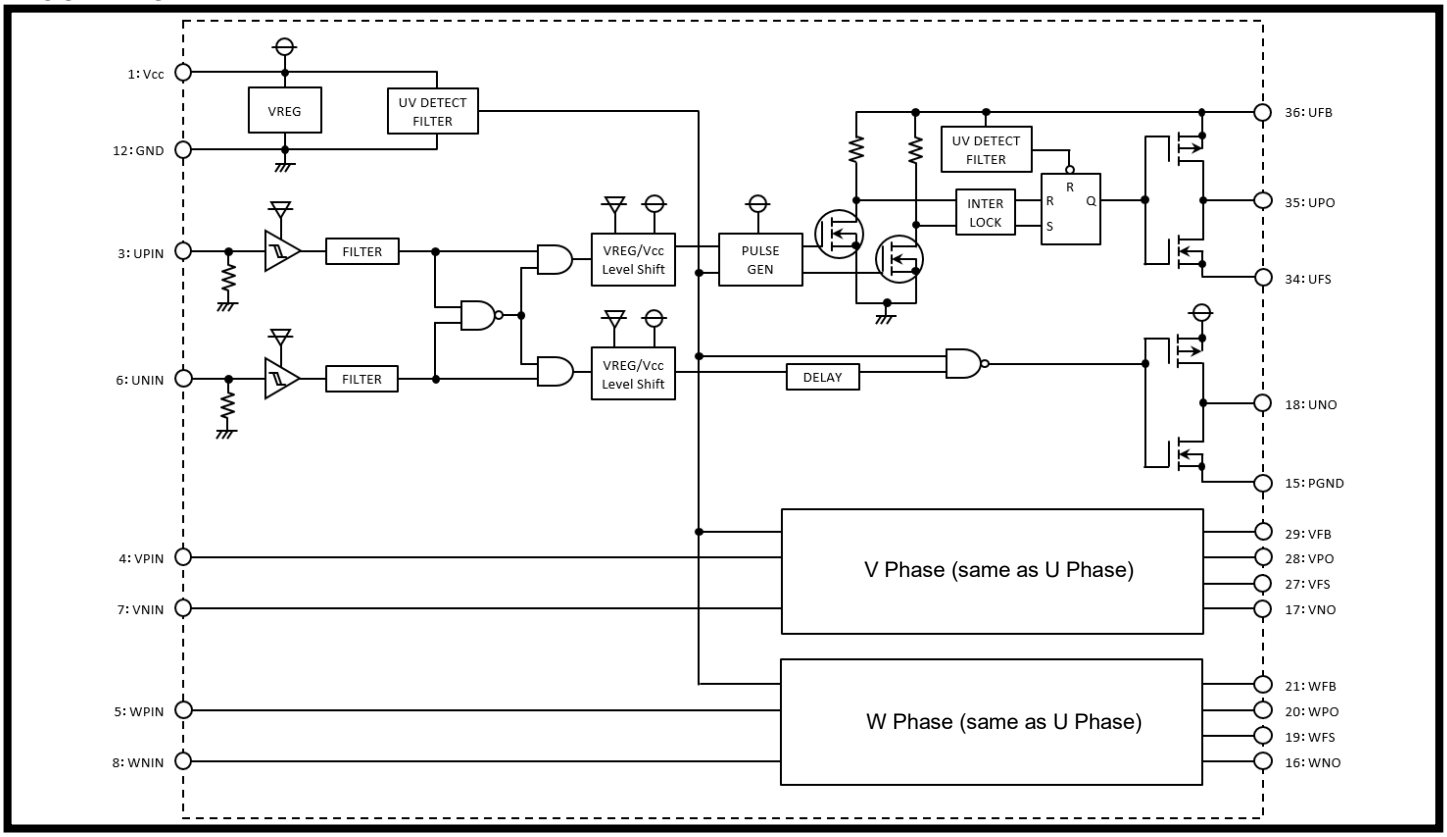
PIN CONFIGURATION (TOP VIEW)



Outline:SSOP36

NC:NO CONNECTION

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Ta=25°C unless otherwise specified) (* :U or V or W Phase)

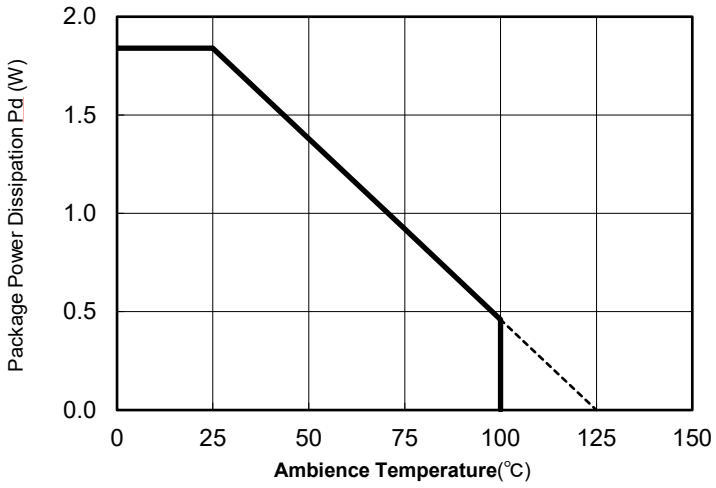
Symbol	Parameter	Conditions	Ratings	Unit
U,V,W_{FB}	High Side Floating Supply Absolute Voltage		-0.5～624	V
U,V,W_{FS}	High Side Floating Supply Offset Voltage		U,V,W_{FB}-24～U,V,W_{FS}+0.5	V
V_{BS}	High Side Floating Supply Voltage	$V_{BS}=*_{FB}-*_{FS}$	-0.5～24	V
U,V,W_{PO}	High Side Output Voltage		U,V,W_{FS}-0.5～U,V,W_{FB}+0.5	V
V_{CC}	Low Side Fixed Supply Voltage		-0.5～24	V
U,V,W_{NO}	Low Side Output Voltage		-0.5～V_{CC}+0.5	V
U,V,W_{IN}	Logic Input Voltage	*PIN,*NIN Terminal	-0.5～V_{CC}+0.5	V
dVS/dt	Allowable Offset Supply Voltage Transient		±50	V/ns
Pd	Package Power Dissipation	Ta=25℃,On Board	1.84	W
Kθ	Linear Derating Factor	Ta> 25℃, On Board	18.4	mW/℃
Rth(j-c)	Junction-Case Thermal Resistance		54.39	℃/W
Tj	Junction Temperature		-20～125	℃
Topr	Operation Temperature		-20～100	℃
Tstg	Storage Temperature	On Board	-40～125	℃
TL	Solder Reflow Condition	Pb-free	255:10s, max260	℃

RECOMMENDED OPERATING CONDITIONS (* :U or V or W Phase)

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
U,V,W_{FB}	High Side Floating Supply Absolute Voltage		V_S+10	—	V_S+20	V
U,V,W_{FS}	High Side Floating Supply Offset Voltage		0	—	500	V
V_{BS}	High Side Floating Supply Voltage	$V_{BS}=*_{FB}-*_{FS}$	10	—	20	V
V_{CC}	Low Side Fixed Supply Voltage		10	—	20	V
V_{IN}	Logic Input Voltage	*PIN,*NIN Terminal	0	—	5	V
V_{PGND}	Power GND		-5	—	5	V

Note: For proper operation, the device should be used within the recommend conditions.

THERMAL DERATING FACTOR CHARACTERISTIC (MAXIMUM RATING)

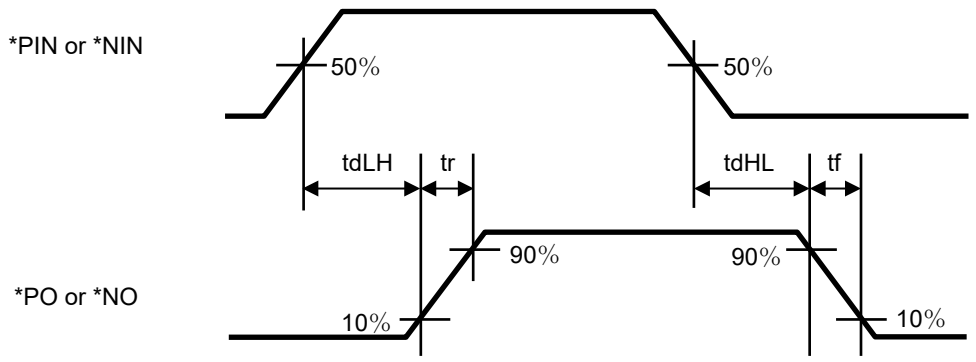


ELECTRICAL CHARACTERISTICS (Ta=25℃, VCC=VBS (=VB–VS)=15V, unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
I_{FS}	Floating Supply Leakage Current	V_B=V_S=600V , 1 per phase	-	-	1.0	μA
I_{BS}	VBS Standby Current	1 per phase	-	0.2	0.5	mA
I_{CC}	VCC Standby Current		-	1.0	2.0	mA
V_{OH}	High Level Output Voltage	I_O=0A, *NO, *PO Terminal	14.9	-	-	V
V_{OL}	Low Level Output Voltage	I_O=0A, *NO, *PO Terminal	-	-	0.1	V
V_{IH}	High Level Input Threshold Voltage	*PIN, *NIN Terminal	2.7	-	-	V
V_{IL}	Low Level Input Threshold Voltage	*PIN, *NIN Terminal	-	-	0.8	V
I_{IH}	High Level Input Bias Current	*PIN, *NIN=5V	0.3	0.5	1.0	mA
I_{IL}	Low Level Input Bias Current	*PIN, *NIN=0V	-	0	-	μA
V_{BSuvr}	VBS Supply UV Reset Voltage		7.5	8.5	9.5	V
V_{BSuvh}	VBS Supply UV Hysteresis Voltage		0.2	0.5	0.8	V
tV_{BSuv}	VBS Supply UV Filter Time		-	7.5	-	μs
V_{CCuvr}	VCC Supply UV Reset Voltage		7.5	8.5	9.5	V
V_{CCuvh}	VCC Supply UV Hysteresis Voltage		0.2	0.5	0.8	V
tV_{CCuv}	VCC Supply UV Filter Time		-	7.5	-	μs
I_{OH}	Output High Level Short Circuit Pulsed Current	*PO,*NO=0V,*PIN,*NIN=5V, PW<10μs	120	200	-	mA
I_{OL}	Output Low Level Short Circuit Pulsed Current	*PO,*NO=15V,*PIN,*NIN=0V,PW<10μs	350	500	-	mA
R_{OH}	Output High Level On Resistance	I_O=-20mA, R_{OH}=(V_{OH}-V_O)/$\|I_O\|$	-	40	70	Ω
R_{OL}	Output Low Level On Resistance	I_O=20mA, R_{OL}=V_O/I_O	-	15	30	Ω
tdLH(PO)	High Side Turn-On Propagation Delay	CL = 1000pF between *PO-*$_{FS}$	340	650	855	ns
tdHL(PO)	High Side Turn-Off Propagation Delay	CL = 1000pF between *PO-*$_{FS}$	340	650	855	ns
trH	High Side Turn-On Rise Time	CL = 1000pF between *PO-*$_{FS}$	20	130	220	ns
tfH	High Side Turn-Off Fall Time	CL = 1000pF between *PO-*$_{FS}$	-	50	75	ns
tdLH(NO)	Low Side Turn-On Propagation Delay	CL=1000pF *NO-PGND	340	650	855	ns
tdHL(NO)	Low Side Turn-Off Propagation Delay	CL=1000pF *NO-PGND	340	650	855	ns
trL	Low Side Turn-On Rise Time	CL=1000pF *NO-PGND	20	100	200	ns
tfL	Low Side Turn-Off Fall Time	CL=1000pF *NO-PGND	-	50	75	ns
ΔtdLH	Delay Matching, High Side and Low Side Turn-On	| tdLH(PO)-tdLH(NO) |	-	-	50	ns
ΔtdHL	Delay Matching, High Side and Low Side Turn-Off	| tdHL(PO)-tdHL(NO) |	-	-	50	ns
tfilter	Input Filter Time	*PIN, *NIN : Convex Pulse	260	380	500	ns
		*PIN, *NIN : Concave Pulse	310	450	590	ns

Note: Typ is not specified

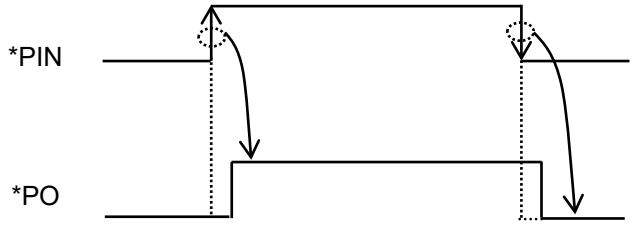
INPUT/OUTPUT TIMING DIAGRAM



FUNCTION TABLE (* :U or V or W Phase)

U,V,WPIN	U,V,WNIN	UV(VCC)	UV(VBS)	U,V,WPO	U,V,WNO	Behavioral state
H→L	L	H	H	L	L	*PO = L, *NO = L
H→L	H	H	H	L	H	*NO = H
L→H	L	H	H	H	L	*PO ON = H
L→H	H	X	H	L	L	*NO,*PO = L when *PIN, *NIN is “L” at the same time
X	L	H	L	L	L	*PO = L when VBS UV tripped.
H→L	X	L	H	L	L	*NO = L when VCC UV tripped

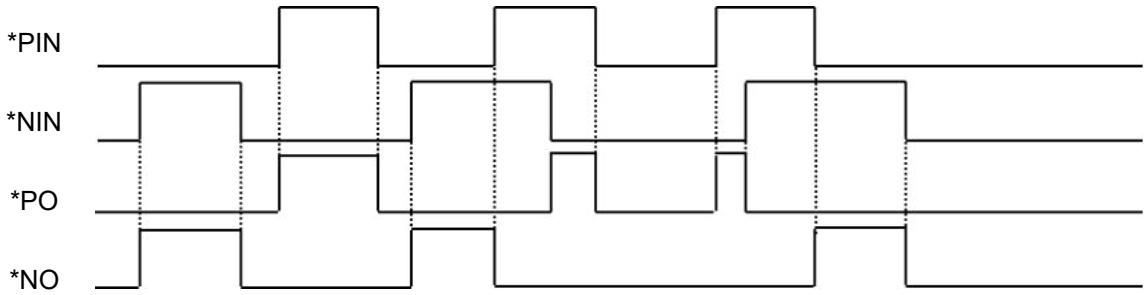
Note1 : “L” state of VBS UV, VCC UV means that UV trip voltage.
Note2 : In the case of both input signals (*PIN and *NIN) are “H”, output signals (*PO and *NO) become “L”.
Note3 : X (*PIN) : L→H or H→LO X (*HIN) : H or L.
Note4 : Output Signal (*PO) is triggered by the edge of input signal.



TIMING DIAGRAM

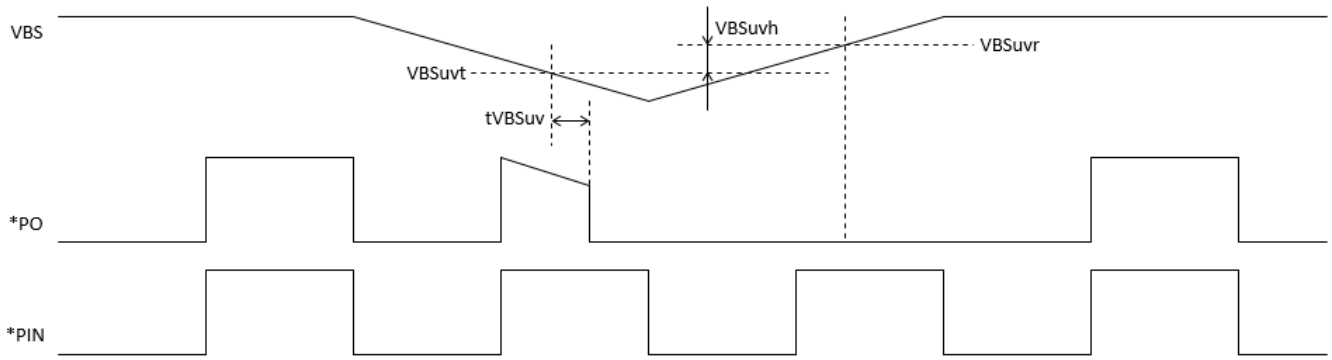
1. INPUT/OUTPUT TIMING DIAGRAM

High Active, in the case of both input signals (*PIN, *NIN) are “H”, output signals (*PO, *NO) become “L”.

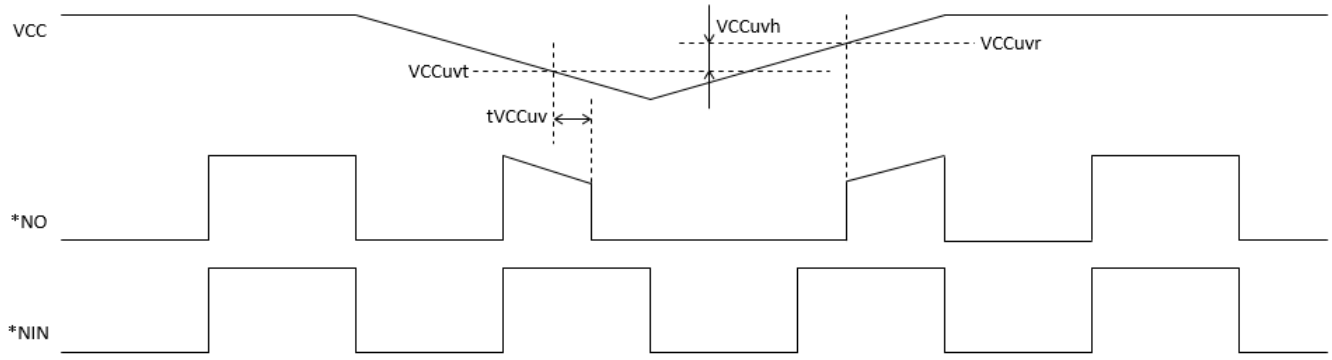


2. VCC (VBS) Supply Under Voltage Lockout Timing Diagram

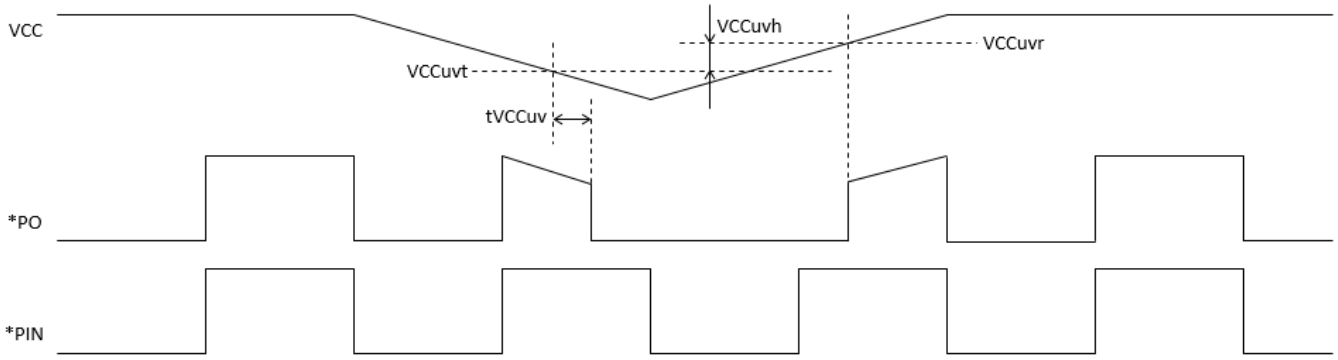
If VBS supply voltage drops below UV trip voltage (VBSuvt) for VBS supply UV filter time, output signal is shut down. As soon as VBS supply voltage rises over UV reset voltage, output signal *PO becomes “H” at following edge of input signal.



If VCC supply voltage drops below UV trip voltage (VCCuvt) for VCC supply UV filter time, *NO output signal is shut down. As soon as VCC supply voltage rises over UV reset voltage, output signal *NO becomes “H” if *NIN input signal is “H”.



If VCC supply voltage drops below UV trip voltage (VCCuvt) for VCC supply UV filter time, *PO output signal is shut down. As soon as VCC supply voltage rises over UV reset voltage, output signal *PO becomes “H” if *PIN input signal is “H”.



3. Allowable Supply Voltage Transient(* :U or V or W Phase)

(1) Allowable supply voltage transient

It is recommended to supply VCC firstly and supply VBS secondly. In the case of shutting off supply voltage, please shut off VBS firstly and shut off VCC secondly.

When applying VCC and VBS, power supply should be applied slowly. If it rises rapidly, output signal (HO* or LO*) may be malfunction.

(2) Supply voltage start up or restart after shut down

If VCC supply is less than 10V(outside of RECOMMENDED OPERATING CONDITIONS), there is some possibility that output does not change in response to input.

Please evaluate carefully about supply start up or restart after shut down in your application systems.

(3) VB* supply voltage

Please use VB* supply voltage within RECOMMENDED OPERATING CONDITIONS(VS* +10V < VB*).

If VB* supply voltage is used on the other conditions, output signal HO* may be malfunction.

Please evaluate carefully about VB* supply voltage in your application systems.

(4) Processing between IC terminals

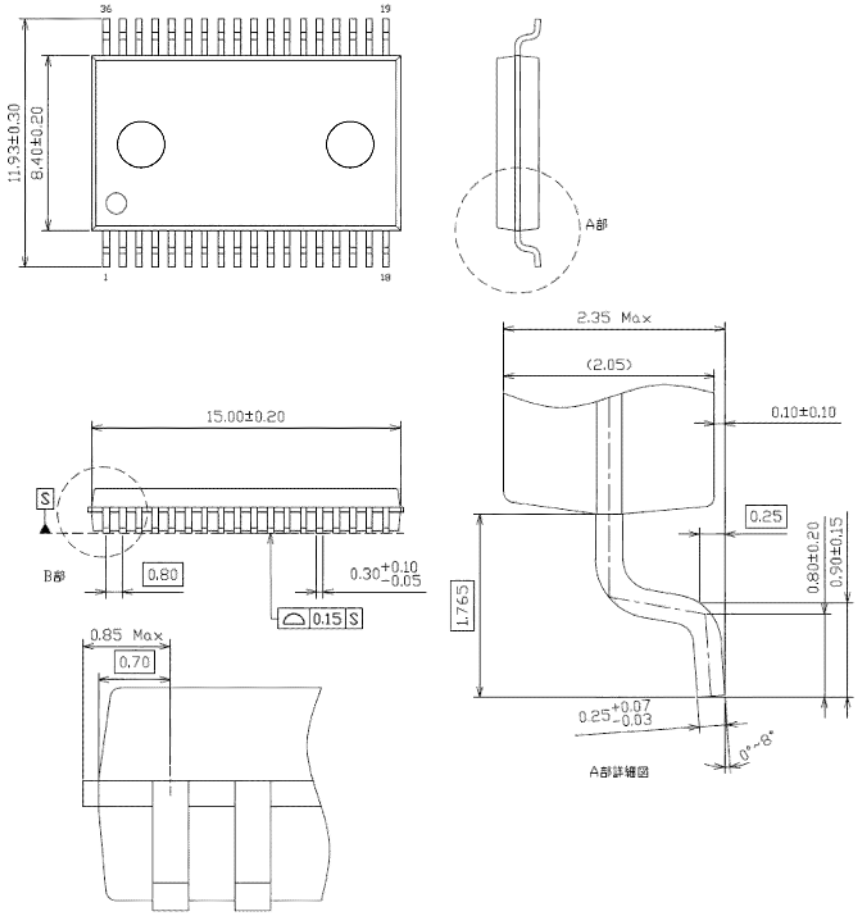
As for this product, the terminal of low voltage part and high voltage part are arranged across the NC terminal (The 14th:LOU, The 16th: VSW). In addition, terminals between 3phase of high voltage parts are adjacent. (The 18th: VBW, The 19th:VSV) (The 21th: VBV, The 22th: VSU) .

Therefore, if insulation space distance of those terminals can not be enough, please coat between those terminals.

ENVIRONMENTAL CONSCIOUSNESS

M81775FP is compliant with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) directive 2011/65/EU+(EU)2015/863.

PACKAGE OUTLINE



Main Revision for this Edition

Rev.	Date	Revision	
		Pages	Points
A	15 Jun. 2017	-	New
B	8 May. 2018	- P2	“PRELIMINARY” was deleted “（）” was deleted in Ratings of Pd, Kθ,Rth(j-c)
C	28 Apr. 2021	-	Update format

Important Notice

The information contained in this datasheet shall in no event be regarded as a guarantee of conditions or characteristics. This product has to be used within its specified maximum ratings, and is subject to customer's compliance with any applicable legal requirement, norms and standards.

Except as otherwise explicitly approved by Mitsubishi Electric Corporation in a written document signed by authorized representatives of Mitsubishi Electric Corporation, our products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.

In usage of power semiconductor, there is always the possibility that trouble may occur with them by the reliability lifetime such as Thermal Cycle or others, or when having assembling stress (e.g. high temperature of reflow process, or rinse after the reflow), or when used under special operating conditions (e.g. rise/fall time of the power supply voltage, or excessive voltage/current injection), or when used under special circumstances (e.g. condensation, high humidity, dusty, salty, highlands, environment with lots of organic matter / corrosive gas / explosive gas, or situations which terminals of semiconductor products receive strong mechanical stress). Therefore, please pay sufficient attention to such circumstances. Further, depending on the technical requirements, our semiconductor products may contain environmental regulation substances, etc. If there is necessity of detailed confirmation, please contact our nearest sales branch or distributor.

The contents or data contained in this datasheet are exclusively intended for technically trained staff. Customer's technical departments should take responsibility to evaluate the suitability of Mitsubishi Electric Corporation product for the intended application and the completeness of the product data with respect to such application. In the customer's research and development, please evaluate it not only with a single semiconductor product but also in the entire system, and judge whether it's applicable. As required, pay close attention to the safety design by installing appropriate fuse or circuit breaker between a high voltage/large current power supply and power semiconductor products(e.g. IGBT, MOSFET) to prevent secondary damage. Please also pay attention to the application note and the related technical information.

Keep safety first in your circuit designs!

Mitsubishi Electric Corporation puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage. Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of non-flammable material or (iii) prevention against any malfunction or mishap.

Notes regarding these materials

- These materials are intended as a reference to assist our customers in the selection of the Mitsubishi semiconductor product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Mitsubishi Electric Corporation or a third party.
- Mitsubishi Electric Corporation assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
- All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Mitsubishi Electric Corporation without notice due to product improvements or other reasons. It is therefore recommended that customers contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor for the latest product information before purchasing a product listed herein.
  The information described here may contain technical inaccuracies or typographical errors. Mitsubishi Electric Corporation assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.
  Please also pay attention to information published by Mitsubishi Electric Corporation by various means, including the Mitsubishi Semiconductor home page (http://www.MitsubishiElectric.com/).
- When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Mitsubishi Electric Corporation assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
- Mitsubishi Electric Corporation semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
- The prior written approval of Mitsubishi Electric Corporation is necessary to reprint or reproduce in whole or in part these materials.
- If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.
  Any diversion or re-export contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
- Please contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor for further details on these materials or the products contained therein.