

Motor  
Connection

HV Batt  
Connection

# Reverse Engineering The Inverter

**⚠ 위험 危險 DANGER**  
**⚠ 고전압 高电压 HIGH VOLTAGE Haute tension**  
이제 차량 운전 시 고전압 회로로 인하여 사망하거나 상해를 입을 수 있습니다.  
• 이 차량에 고전압 회로가 포함되어 있습니다.  
• 이 차량을 수리할 때는 고전압 회로에 대한 안전 수칙을 꼭 지켜주세요.  
• 고전압 회로에 접근할 때는 반드시 안전장비를 착용하십시오.  
Non-compliance with the following instructions can induce death or injury caused by electric shock.  
• Carefully read and follow service manual instruction.  
• Always wear insulated gloves and use insulated tools.  
• Remove ignition key and 12V ground cable, shut off main switch.  
• Check Voltage at High voltage terminal.  
La dérogation aux consignes suivantes pourrait entraîner des blessures graves, voire mortelles, causées par un choc électrique.  
• Lire attentivement et suivre les consignes énoncées dans le manuel d'atelier.  
• Toujours porter des gants isolants et utiliser des outils isolants.  
• Retirer la clé de contact et la câble de masse de 12 V et couper l'interrupteur principal.  
• Vérifier la tension au niveau de la borne haute tension.  
未遵守以下条件时，因受高压电击可能导致死亡或受伤。  
• 维修人员要严格按照维修手册中的程序执行操作。  
• 维修时佩戴绝缘手套，使用绝缘工具。  
• 取下点火钥匙和12V接地线并断开主开关。  
• 维修前确认高压端子之间的电压小于30V。  
En caso de no proceder con las siguientes indicaciones puede causar la muerte o heridas por el alto voltaje.  
• Prestar atención a las indicaciones después de leer el manual de servicio de mantenimiento.  
• Utilice siempre los guantes aislantes y herramientas aislantes.  
• Retire la llave de encendido y el contacto de tierra de 12V y apague el interruptor de seguridad de la batería de alto voltaje.  
• Verifique el voltaje entre los contactos de alto voltaje que sea inferior a 30V.

**KIA**  
**EPCU MODULE**  
**HMC P/N: 36600 - 0E350**  
**MOBIS**  
**MCU : EAEHDL - MS4 - D000**  
**VCU/LDC : EAEH5L - NS5 - D040**  
**OBC : AEE0ES15R0**



# Mitsubishi CT600CJ1A060 IGBT Module & Gate Driver Board

HV Pos

HV Neg

Motor output

U

Motor output

V

Motor output

W

Header connection  
From Main MCU

366180E050  
GATE BOARD  
20190305

212S4A7  
OK X 8911  
A1115

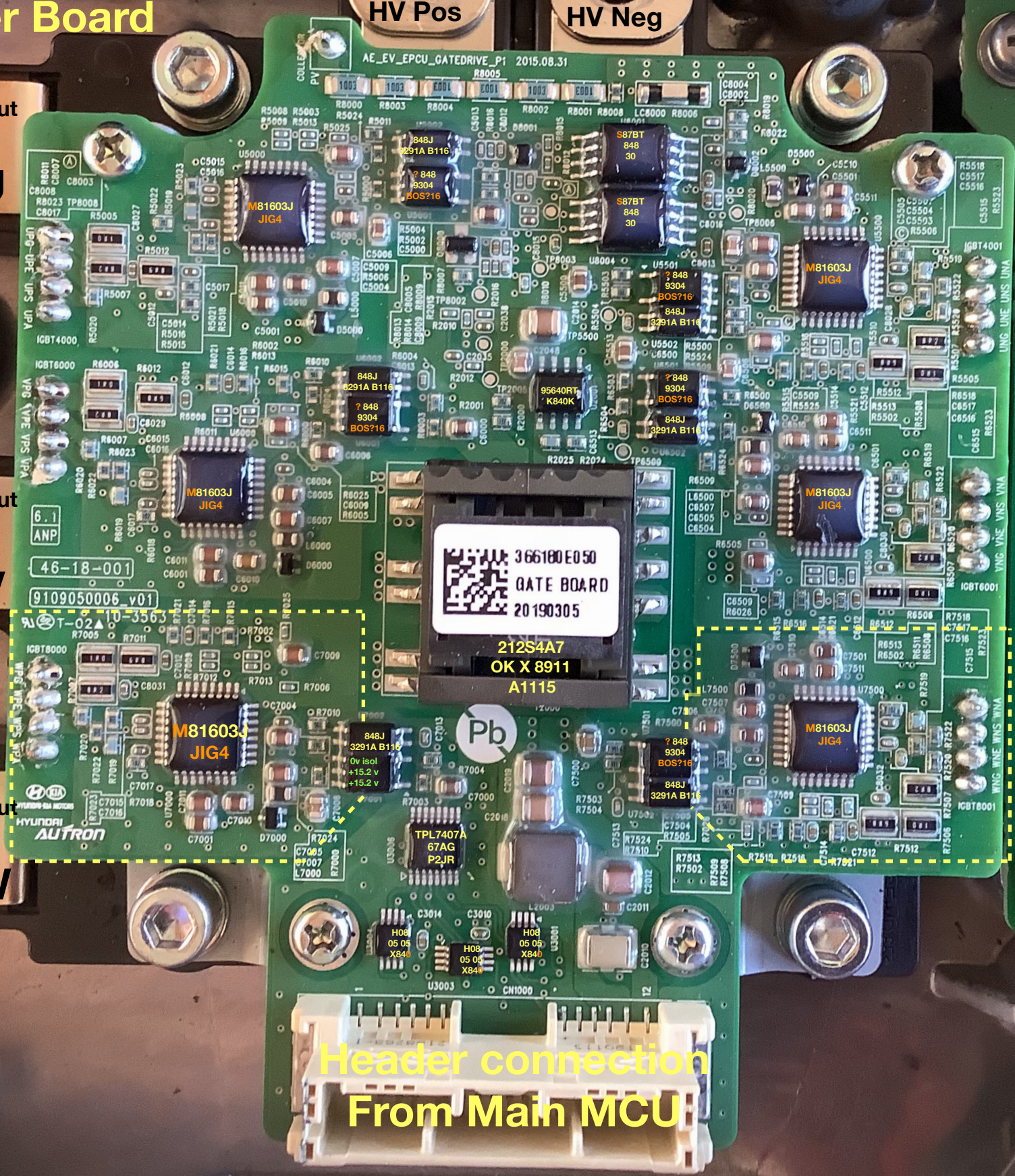


HYUNDAI  
MOBIS

AEVCT CT1882-12

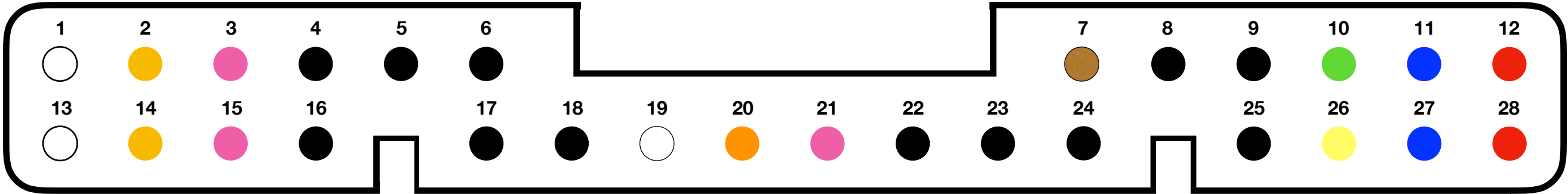
AE EV LDC POWER1 V2.1  
P/N: M30420013261  
2018.03.15

600SFK30M1J 17937





**Gate Board Header**  
(PBT A 2188270 TE)  
ENG CD 2188270 B



(Looking from wire entry)

Gate board Pinout						
Pin No	Wire Colour	Function	Desti natio	B+	IGN 1	IGN 2
1	White	V+	MCU	.027v	12.96v	12.96v
2	Orange	Ground-1	MCU			0.002
3	Pink		MCU			0.020
4	Black		MCU			0.41
5	Black		MCU			0.001
6	Black		MCU			.018v
7	Brown		MCU			.018v
8	Black		MCU			.018v
9	Black		MCU			.018v
10	Green		MCU			.018v
11	Blue	Transformer Pin 9,10,11	MCU			.018v
12	Red	Ground 1 -Transf. pin 13	MCU			0.001

**This is the Pinout on the Gateboard header. I haven't figured it out at all yet besides the power supply pins.**

Gate board Pinout						
Pin	Wire	Function	Destin	B+	IGN 1	IGN 2
13	White	5v+	MCU		5.066v	5.066v
14	Orange		MCU		.018v	.018v
15	Pink	3.93v	MCU		3.93v	3.93v
16	Black	5v+	MCU		5.066v	5.066v
17	Black	5v+	MCU		5.066v	5.066v
18	Black		MCU		0.02	0.02
19	White		MCU		0.013	0.013
20	Orange	Ground -1	MCU		.018v	.018v
21	Pink	4.6v	MCU		4.6v	4.6v
22	Black		MCU		.018v	.018v
23	Black	4.6v	MCU		4.6v	4.6v
24	Black		MCU		0.001	0.001
25	Black	11.42v	MCU		11.42v	11.42v
26	Yellow	11.42v	MCU		11.42v	11.42v
27	Blue		MCU		.018v	.018v
28	Red	Ground-1	MCU		.018v	.018v

**I measured DC volt on each pin with B+, IG1, & IG2 connected. HV Battery was disconnected**

# Gate Board Transformer

I found these diagrams on the TDK website.

Not the exact part number but similar to the transformer on the Ioniq's Gate board Transformer (Part No 212S4A7 OK X 8911 A1115)

And it does give an overview of how it works



**Transformer P/N**  
**212S4A7**  
**TDK X 8911**  
**A1115**

9:07 pm Mon 6 Sep

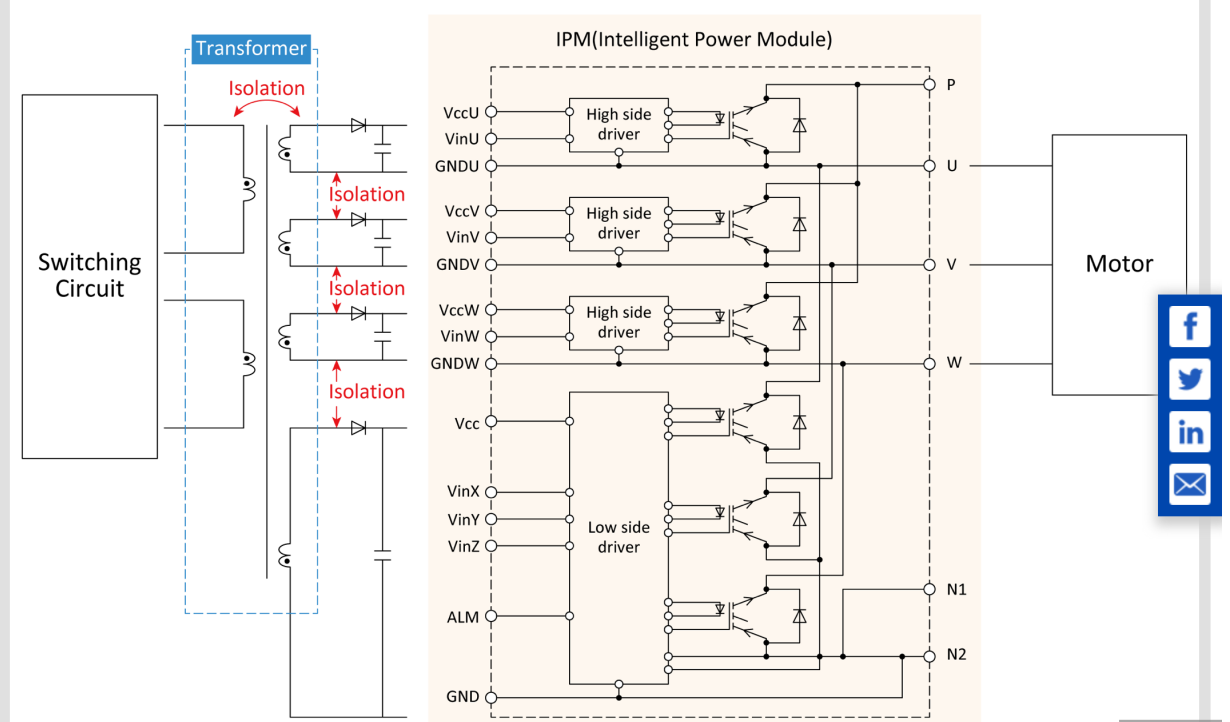
Motor-Inverter Circuit Configuration Example | Application Note | TDK Product Center (2 of 191)

Table 2 : Differences in structure and lineup

Transformer type	Distributed transformers	Centralized transformers
Circuit diagram		
Number of outputs	1 ~ 2	3 ~ 6
Advantages	Small size increases layout design freedom Low weight improves vibration	Total cost is lower than distributed type.

11:04 am Mon 6 Sep

Figure 7 : Example of IGBT/FET drive transformer



## Required Transformer Characteristics

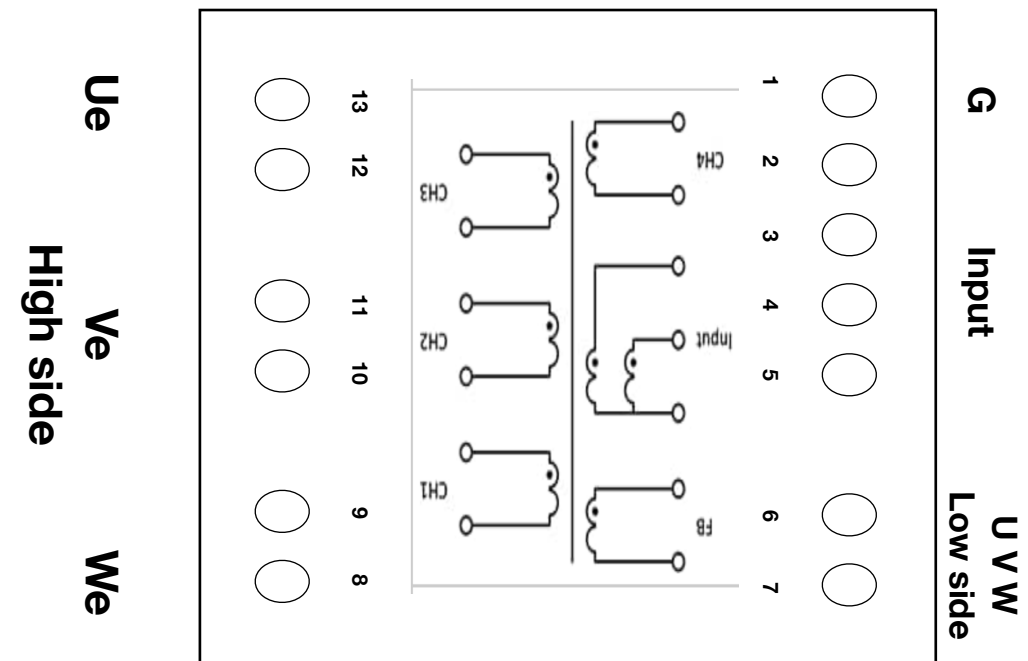
• **High reliability:** Insulation between windings on the secondary side is essential  
 (there is a constant harsh, high-voltage environment (400 V/800V) for extended periods between the windings)



**(All Readings in situ in ohms Looking from Top)**

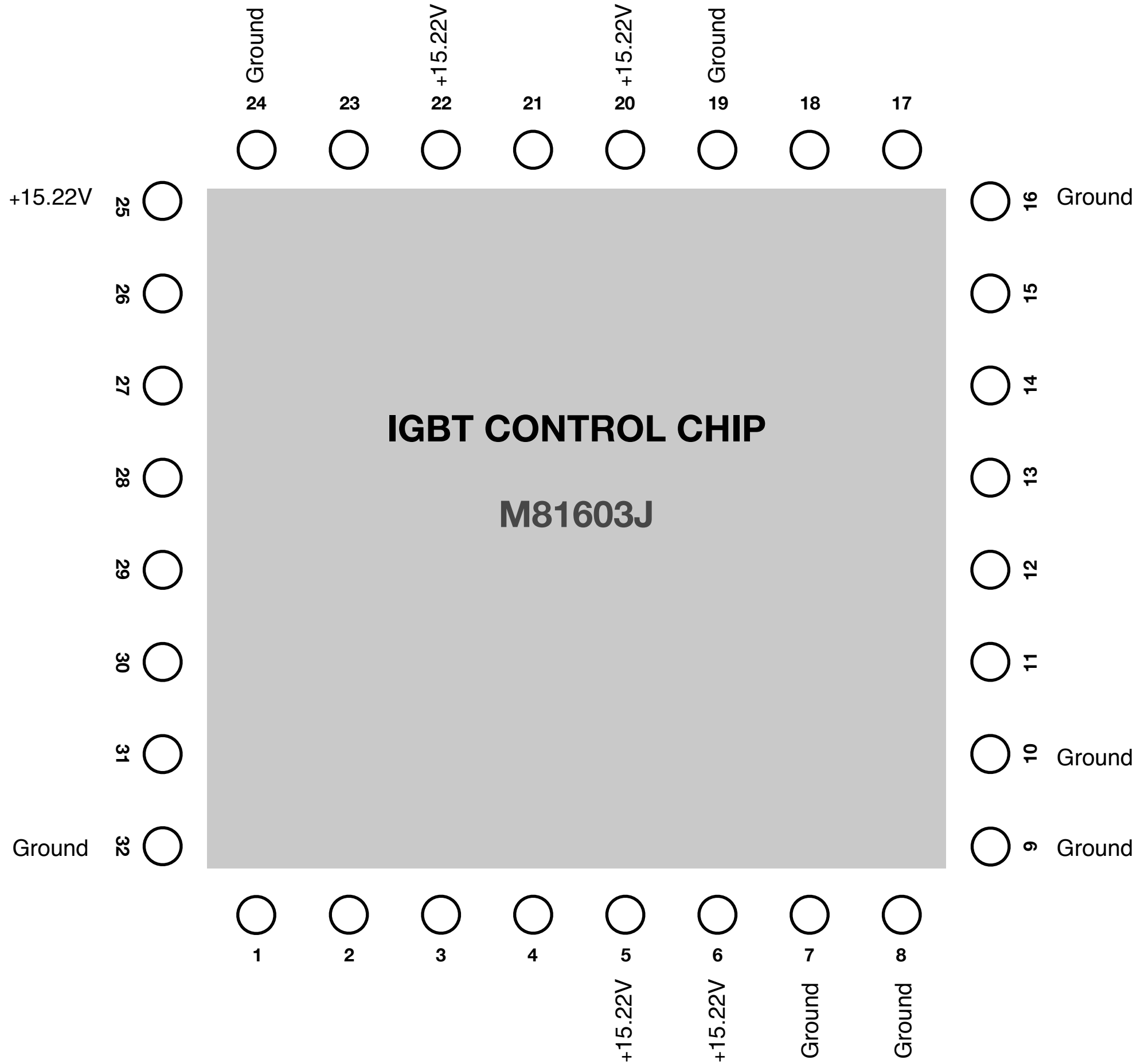


**212S4A7**  
**TDK X 8911**  
**A1115**



**All 3 low side IGBT emitters connect to Transformer term 6**  
**Term 1 connects to LV power supply ground**  
**Term 13 connects to U emitter**  
**Term 11 connects to V emitter**  
**Term 9 connects to W emitter**







# IGBT control chip. Measured in situ voltages

M81603 J Gate control IC phase W							V12.94+ From mcu				
Pin		Function	Destinati	Res	Destinatio	Res	Isol Gnd				
1				/			2.567				
2							3.078				
3							2.187				
4							2.756				
5		VCC W					15.22				
6		VCC W					15.22				
7		Isolated Ground	WPS	27			0	Trans pin 9			
8		Isolated Ground	WPS	27			0				
9		Isolated Ground	WPS	27	WPE	0	0				
10		Isolated Ground	WPS	27	WPE	0	0				
11							0.074				
12							0.074				
13							0				
14							0				
15							0				
16		Isolated Ground	WPS	0	WPE	0	0				
17			WPG	20			0				
18			WPG	30			0				
19		Isolated Ground	WPS	0	WPE	0	0				
20		VCC W					15.22				
21							0				
22		VCC W					15.22				
23							12.37				
24		Isolated Ground	WPS	27	WPE	0	0				
25		VCC W					15.22				
26							12.37				
27							15.22				
28							6.538				
29							0.008				
30							14.37				
31							0.003				
32		Isolated Ground	WPS	27	WPE	0	0				