

Description

The DFS05HF12EZA1 is a Half Bridge SiC MOSFET half bridge Power Module. It integrates high performance SiC MOSFET chips designed for the applications such as Solar Inverter, UPS, Fuel cell- DC/DC converter, Energy storage Systems.



Features

- Blocking voltage:1200V
- $R_{ds(on)}=5.0m\Omega / T_j=25^\circ C, V_{GS}=18V$
- Low Switching Losses
- 175°C maximum junction temperature
- Thermistor inside

Applications

- Solar inverter Systems
- Fuel cell-DC/DC converter
- Uninterruptible Power Supplier
- Energy Storage Systems

Circuit diagram

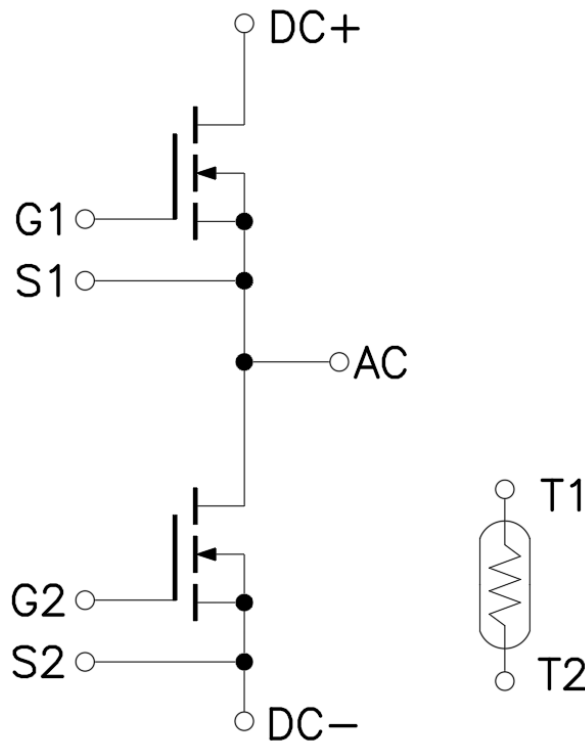


Figure 1. Out drawing & circuit diagram for DFS05HF12EZA1

Pin Configuration and Function Description

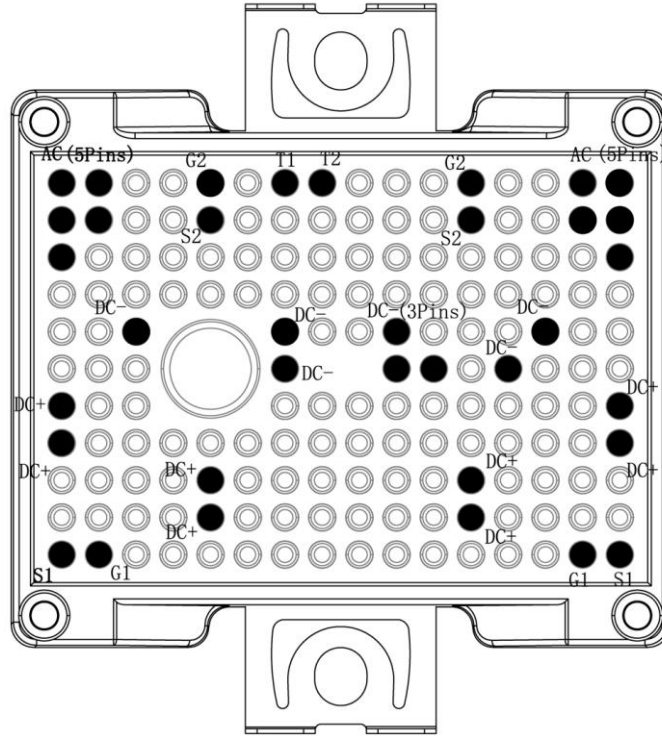


Figure 2. Pin configuration

PIN No.	Symbol	Description
1-5(5pins)	AC	Output terminal of half bridge
6	S2	Low side source signal terminal
7	G2	Low side gate signal terminal
8	TH1	Thermistor connection 1
9	TH2	Thermistor connection 2
10	S2	Low side source signal terminal
11	G2	Low side gate signal terminal
12-16(5pins)	AC	Output terminal of half bridge
17-24(8pins)	DC –	DC – Bus connection
25-32(8pins)	DC +	DC + Bus connection
33	S1	High side source signal terminal
34	G1	High side gate signal terminal
35	G1	High side gate signal terminal
36	S1	High side source signal terminal

Maximum Ratings (T_j=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V _{DSS}	Drain-Source Voltage	G-S Short	1200	V
V _{GSS}	G-S Voltage	D-S Short, Note1	-10 to 23	V
I _{DS}	DC Continuous Drain Current	T _C =25°C	378	A
		T _C =100°C	240	
I _{DP}	Drain Pulse Current, Peak	Less than 1ms, Note2	480	A
P _{tot}	Total Power Dissipation	T _C =25°C	1389	W
T _{jmax}	Max Junction Temperature	-	175	°C
T _{stg}	Storage temperature	-	-40 to 125	°C

Note1: Recommended Operating Value, -4V/+18V

Note2: Pulse width limited by maximum junction temperature

Module

Parameter	Conditions	Value	Unit
Isolation voltage	RMS, f =50Hz, t =1min	3.4	kV
Clearance	Terminal to Terminal	5	mm
	Terminal to Heatsink	10	mm
Creepage distance	Terminal to Terminal	6.3	mm
	Terminal to Heatsink	12.7	mm
Stray inductance	-	7	μH
Comparative Tracking Index	-	200	-

NTC characteristics

Symbol	Parameter	Condition	Value			Unit
			Min.	Typ.	Max.	
R ₂₅	Resistance	T _C =25°C	-	5	-	kΩ
ΔR/R	Deviation of R100	T _C =100°C, R ₁₀₀ =493Ω	-5	-	5	%
P ₂₅	Power dissipation	T _C =25°C	-	-	20	mW
B _{25/50}	B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15 K))]$	-	3375	-	K
B _{25/80}	B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15 K))]$	-	3411	-	K
B _{25/100}	B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15 K))]$	-	3433	-	K

MOSFET Electrical characteristics ($T_j=25^\circ\text{C}$ unless otherwise specified, chip)

Symbol	Item	Condition	Value			Unit	
			Min.	Typ.	Max		
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=0.3mA$	1200	-	-	V	
I_{DSS}	Zero gate voltage drain Current	$V_{DS}=1200V, V_{GS}=0V, T_j=25^\circ\text{C}$	-	3	150	μA	
$V_{GS(th)}$	Gate-source threshold Voltage	$I_D=81mA, V_{DS}=V_{GS}$	$T_j=25^\circ\text{C}$	2.0	2.8	3.7	V
			$T_j=150^\circ\text{C}$	-	2.1	-	
			$T_j=175^\circ\text{C}$	-	2.0	-	
I_{GSS+}	Gate-Source Leakage Current	$V_{GS}=18V, V_{DS}=0V$	$T_j=25^\circ\text{C}$	-	6	-1200	nA
I_{GSS-}		$V_{GS}=-4V, V_{DS}=0V$	$T_j=25^\circ\text{C}$	-1200	-6	0	
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	$I_D=240A$ $V_{GS}=18V$	$T_j=25^\circ\text{C}$	-	5.4	-	mΩ
			$T_j=150^\circ\text{C}$	-	8.3	-	
			$T_j=175^\circ\text{C}$	-	9.3	-	
$V_{DS(on)}$ (Chip)	Static drain-source On-state Voltage	$I_D=240A$ $V_{GS}=18V$	$T_j=25^\circ\text{C}$	-	1.20	-	V
			$T_j=150^\circ\text{C}$	-	1.99	-	
			$T_j=175^\circ\text{C}$	-	2.23	-	
C_{iss}	Input Capacitance	$V_{DS}=1000V$	-	12.9	-	nF	
C_{oss}	Output Capacitance	$V_{GS}=0V$	-	0.642	-	nF	
C_{rss}	Reverse transfer Capacitance	$f=100kHz$	-	0.057	-	nF	
Q_g	Total gate charge	$V_{DS}=800V$	-	666	-	nC	
Q_{gs}	Gate-source charge	$I_D=240A$	-	165	-		
Q_{gd}	Gate-drain charge	$V_{GS}=+18/-4V$	-	264	-		
R_{gint}	Internal gate resistor	$f=1MHz$	-	1.467	-	Ω	
$t_{d(on)}$	Turn-on delay time		$T_j=25^\circ\text{C}$	-	17	-	ns
			$T_j=150^\circ\text{C}$	-	15	-	
t_r	Rise time	$V_{DS}=800V$ $I_D=240A$	$T_j=25^\circ\text{C}$	-	27	-	ns
			$T_j=150^\circ\text{C}$	-	25	-	
$t_{d(off)}$	Turn-off delay time	$V_{GS}=+18/-4V$ $R_{G(ON)}=2\Omega$	$T_j=25^\circ\text{C}$	-	40	-	ns
			$T_j=150^\circ\text{C}$	-	42	-	
t_f	Fall time	$R_{G(OFF)}=2\Omega$ Inductive load	$T_j=25^\circ\text{C}$	-	9	-	ns
			$T_j=150^\circ\text{C}$	-	11	-	
E_{on}	Turn-on power dissipation	switching operation	$T_j=25^\circ\text{C}$	-	3.42	-	mJ
E_{off}	Turn-off power dissipation		$T_j=25^\circ\text{C}$	-	0.42	-	mJ
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case	-	0.09	-	K/W	
$R_{th(c-f)}$	Contact thermal Resistance	With thermal conductive grease, Note3	-	0.12	-	K/W	

Note3: Assumes Thermal Conductivity of grease is 2.8 W/m · K and thickness is 50um.

Body Diode Electrical characteristics (T_j=25°C unless otherwise specified, chip: Target)

Symbol	Item	Condition	Value			Unit	
			Min.	Typ.	Max		
V _{SD}	Body Diode Forward Voltage	V _{GS} = -4V I _{SD} = 120A	T _j = 25°C	-	4.1	-	V
			T _j = 175°C	-	3.6	-	
T _{rr}	Reverse recovery time	V _{DD} = 800V, I _D = 240A	T _j = 25°C	-	21	-	ns
Q _{rr}	Reverse recovery charge	V _{GS} = +18/-4V	T _j = 25°C	-	1.41	-	μC
I _{rrm}	Peak Reverse Recovery Current	R _{G(ON)} = R _{G(OFF)} = 2Ω Inductive load switching operation			120		A

Test Conditions

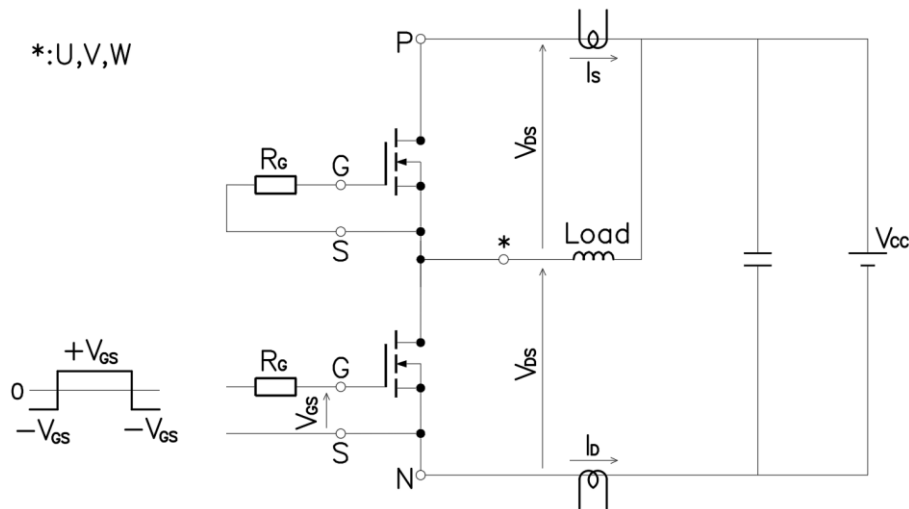


Figure 3. Switching time measure circuit

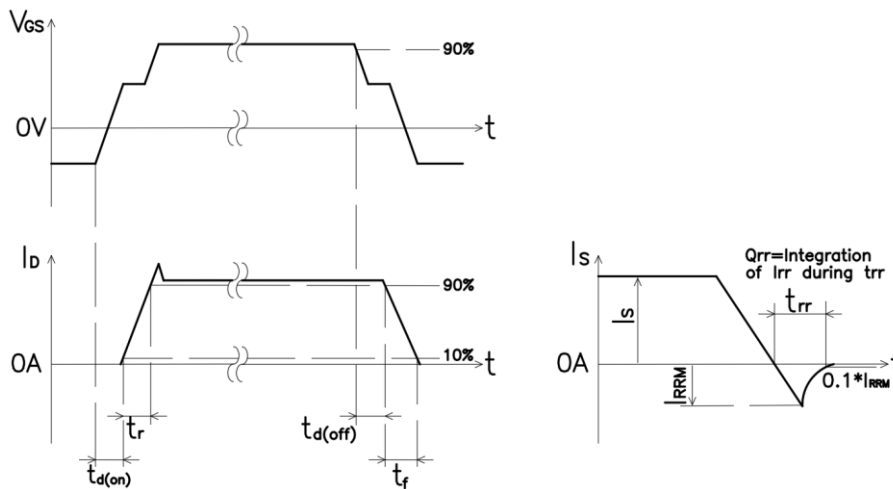


Figure 4. Switching time definition

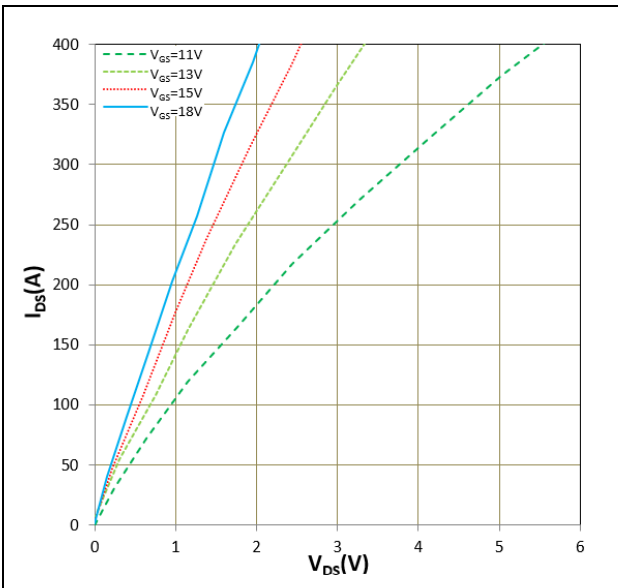


Figure 5. I_{DS} vs V_{DS}
 $T_j = 25^\circ\text{C}$

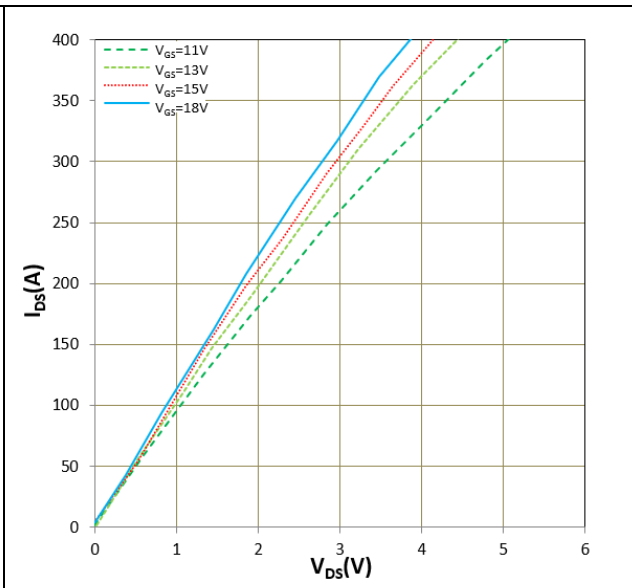


Figure 6. I_{DS} vs V_{DS}
 $T_j = 175^\circ\text{C}$

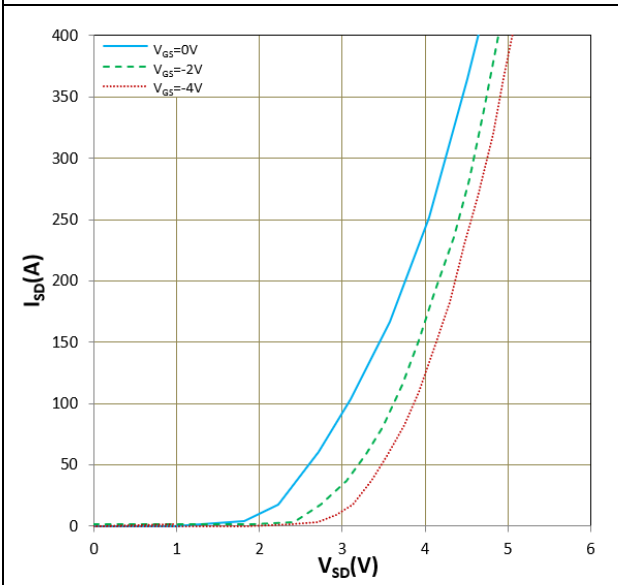


Figure 7. I_{SD} vs V_{SD}
 $T_j = 25^\circ\text{C}$

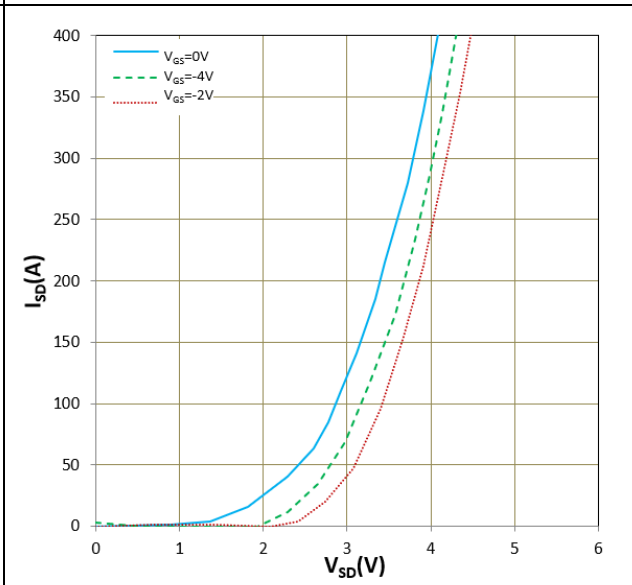


Figure 8. I_{SD} vs V_{SD}
 $T_j = 175^\circ\text{C}$

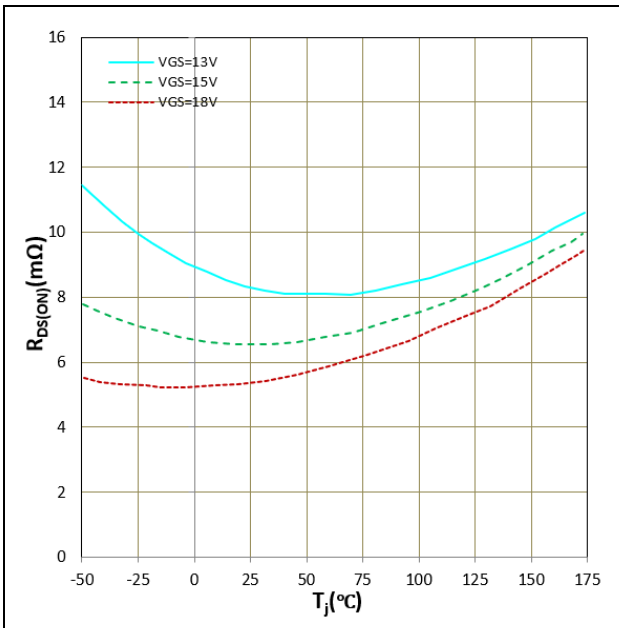


Figure 9. $R_{DS(ON)}$ vs T_j
 $I_D = 240A$

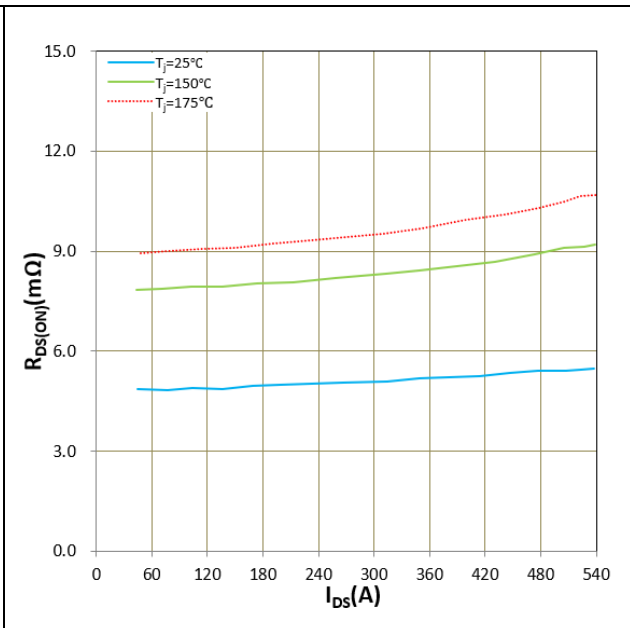


Figure 10. $R_{DS(ON)}$ vs I_{DS}
 $V_{GS} = +18V$

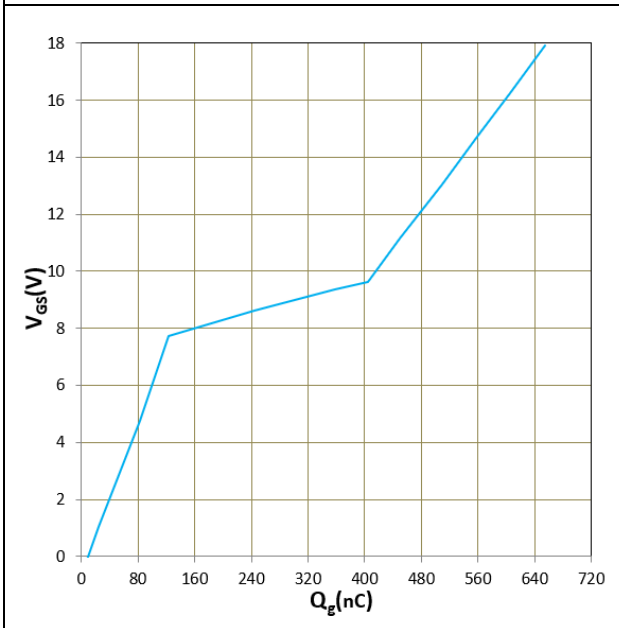


Figure 11. V_{GS} vs Q_g
 $T_j = 25°C$, $V_{DS} = 800V$, $I_D = 240A$

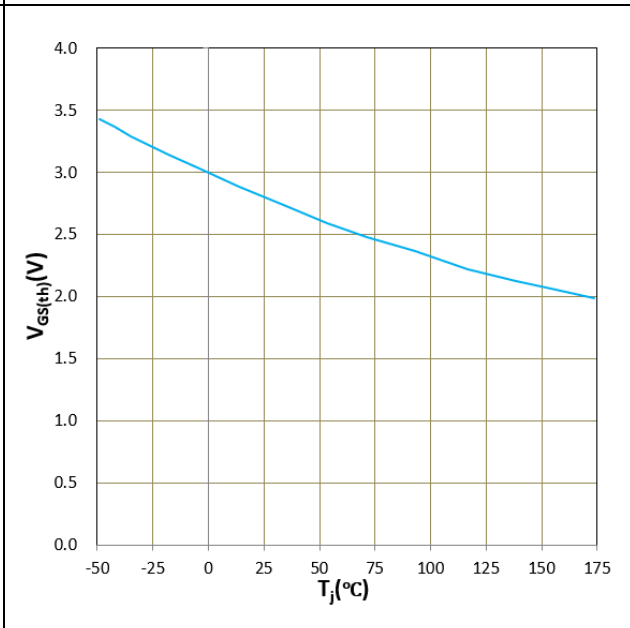
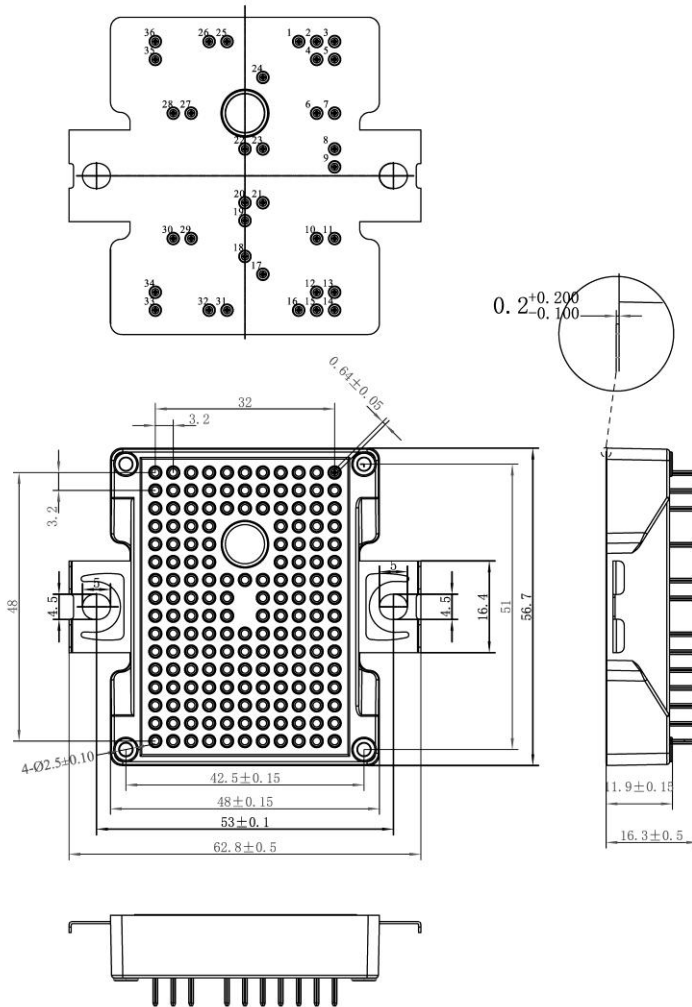


Figure 12. $V_{GS(th)}$ vs T_j
 $V_{GS} = V_{DS}$, $I_D = 81mA$

Package dimensions



Pin	X	Y
1	25,6	48
2	28,8	48
3	32	48
4	28,8	44,8
5	32	44,8
6	28,8	35,2
7	32	35,2
8	32	28,8
9	32	25,6
10	28,8	12,8
11	32	12,8
12	28,8	3,2
13	32	3,2
14	32	0
15	28,8	0
16	25,6	0
17	19,2	6,4
18	16	9,6
19	16	16
20	16	19,2
21	19,2	19,2
22	16	28,8
23	19,2	28,8
24	19,2	41,6
25	12,8	48
26	9,6	48
27	6,4	35,2
28	3,2	35,2
29	6,4	12,8
30	3,2	12,8
31	12,8	0
32	9,6	0
33	0	0
34	0	3,2
35	0	44,8
36	0	48

Unit: mm

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