

Silicon Field Stop(FS) Planar IGBT Module

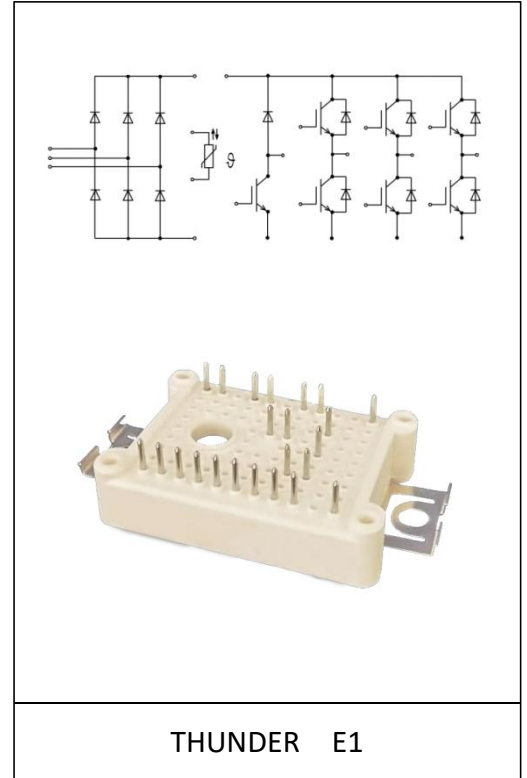
Description

The THGM15N120E1BE is use advanced field stop(FS) technology.

The 1200V FS IGBT module offers superior conduction and switching performances.

General Features

- 1200V Breakdown Voltage
- Low saturation voltage: $V_{CE(sat)}$, typ=2.3V@ $I_C=15A$
- FS Planar Technology, Positive temperature coefficient
- High speed switch & Low power loss



Application

- The inverter
- Motor control and drives

Product Summary

V_{CE}	1200V
$V_{CE(sat)}$	2.3V
I_C	15A

MAXIMUM RATINGS ($T_J = 25^{\circ}C$ unless otherwise noted)

Parameter		Symbol	Value	Unit
Collector-to-Emitter Voltage		V_{CE}	1200	V
Gate-to-Emitter Voltage		V_{GE}	± 30	V
Collector Current	$T_C = 25^{\circ}C$	I_C	30	A
	$T_C = 100^{\circ}C$		15	
Power Dissipation	$T_C = 25^{\circ}C$	P_D	300	W
	$T_C = 100^{\circ}C$		150	

Pulsed Collector Current	$T_C = 25^\circ\text{C}$ $t_p = 10\mu\text{s}$ (Note 1)	I_{CM}	45	A
Diode Forward Current	$T_C = 25^\circ\text{C}$	I_F	30	
	$T_C = 100^\circ\text{C}$		15	
Pulsed Diode Forward Current	$T_C = 25^\circ\text{C}$ $t_p = 10\mu\text{s}$ (Note 1)	I_{FM}	45	
Short Circuit Withstand Time $V_{GE} = 15\text{ V}$, $V_{CC} = 800\text{ V}$, $T_C = 150^\circ\text{C}$		T_{SC}	10	μs
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55 To +175	$^\circ\text{C}$
Lead Temperature for Soldering Purposes		T_L	270	

THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case for IGBT	R_{thJC}	0.5	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient	R_{thJA}	62.5	

ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		

OFF CHARACTERISTICS

Collector-to-Emitter Breakdown Voltage	BV_{CES}	1200	-	-	V	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$
Zero Gate Voltage Collector Current	I_{CES}	-	-	40	μA	$V_{GE} = 0\text{ V}, V_{CE} = V_{CES}$
Gate-to-Emitter leakage Current	I_{GES}	-	-	± 400	nA	$V_{GE} = \pm 30\text{ V}, V_{CE} = 0\text{ V}$

ON CHARACTERISTICS

Gate-to-Emitter Threshold Voltage	$V_{GE(th)}$	4.8	-	6.6	V	$V_{GE} = V_{CE}, I_C = 1\text{ mA}$, $T_J = 25^\circ\text{C}$
Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$	-	2.3	2.8	V	$V_{GE} = 15\text{ V}, I_C = 15\text{ A}$, $T_J = 25^\circ\text{C}$

DYNAMIC CHARACTERISTICS

Input Capacitance	C_{IES}	-	1213	-	pF	$V_{CE} = 15\text{ V}, V_{GE} = 0\text{ V},$ $f = 1\text{ MHz}$
Output Capacitance	C_{OES}	-	81	-		
Reverse Transfer Capacitance	C_{RES}	-	29	-		
Total Gate Charge	Q_G	-	80	-	nC	$V_{CE} = 600\text{ V}, V_{GE} = 15\text{ V},$ $I_C = 15\text{ A}$

SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(on)}$	-	85	-	ns	$V_{CE}= 600\text{ V}$ $V_{GE}= 0/15\text{ V}$ $I_C= 15\text{ A}$ $R_G= 30\ \Omega$ $T_J= 25^{\circ}\text{C}$
Turn-Off Delay Time	$t_{d(off)}$	-	109	-		
Rise time	t_r	-	28	-		
Fall time	t_f	-	220	-		
Turn-On Switching Loss	E_{on}	-	3.0	-	mJ	
Turn-Off Switching Loss	E_{off}	-	0.4	-		
Total Switching Loss	E_{ts}	-	3.4	-		

ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise specified) (continued)

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		

SWITCHING CHARACTERISTICS
DIODE CHARACTERISTICS

Diode Forward Voltage	V_F	-	2.2	3.3	-	$I_F = 15\text{ A}, T_J = 25^\circ\text{C}$
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DIODE SWITCHING CHARACTERISTICS, INDUCTIVE LOAD

Reverse Recovery Time	t_{rr}	-	30	-	ns	$V_R = 600\text{ V}, I_F = 15\text{ A},$ $dI_F/dt = 200\text{ A}/\mu\text{s}$ $T_J = 25^\circ\text{C}$
Reverse Recovery Charge	Q_{rr}	-	2250	-	nC	
Reverse Recovery Energy	E_{rec}	-	0.02	-	mJ	
Peak Reverse Recovery Current	I_{RRM}	-	12	-	A	

Maximum Rated Values (Diode Rectifier)

Symbol	Parameter	Conditions	Value	Unit
V_{RRM}	Repetitive peak reverse voltage		1600	V
$I_{F(AV)}$	Continuous forward current	$T_c = 100\text{ }^{\circ}\text{C}$	15	A
I_{FSM}	Single pulse forward current	$T_c = 25\text{ }^{\circ}\text{C}$	150	A
T_j	Operating junction		175	$^{\circ}\text{C}$
T_{stg}	Storage temperatures		-55to+175	$^{\circ}\text{C}$

Characteristic Values (Diode Rectifier)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{BR}	Reverse breakdown voltage	$I_R = 100\mu\text{A}$	1650	-	-	V
V_F	Forward voltage	$I_F = 15\text{A}$	-	1.20	1.40	V
		$I_F = 15\text{A}, T_j = 125\text{ }^{\circ}\text{C}$	-	1.05	1.25	V
I_R	Forward voltage	$V_R = 1600\text{V}$	-	-	1	μA
		$T_j = 150\text{ }^{\circ}\text{C}, V_R = 1600\text{V}$	-	-	400	μA

NTC-Thermistor (Characteristic Values)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated resistance	$T_c = 25\text{ }^{\circ}\text{C}$	-	5	-	K Ω
$\Delta R/R$	Deviation of R100	$T_c = 100\text{ }^{\circ}\text{C}$	-5	-	5	%
P_{25}	Power dissipation	$T_c = 25\text{ }^{\circ}\text{C}$	-	20	-	mW
$B_{25/50}$	B-value	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298,15\text{K}))]$	-	3375	-	K
$B_{25/100}$	B-value	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298,15\text{K}))]$	-	3442	-	K

Module Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{isol}	Isolation voltage	$t = 1\text{min}, f = 50\text{Hz}$	2500	-	-	V
T_{stg}	Storage Temperature		-40	-	125	$^{\circ}\text{C}$
F	Mounting Force per Clamp		20	-	50	N
G	Weight of Module		-	25	-	g

Typical Performance Characteristics

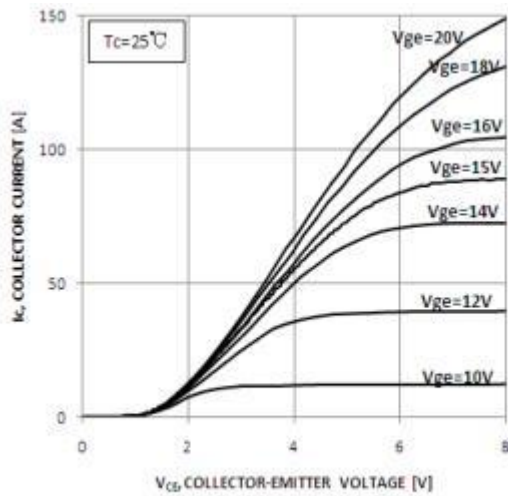


Figure 1. Typical Output Characteristics

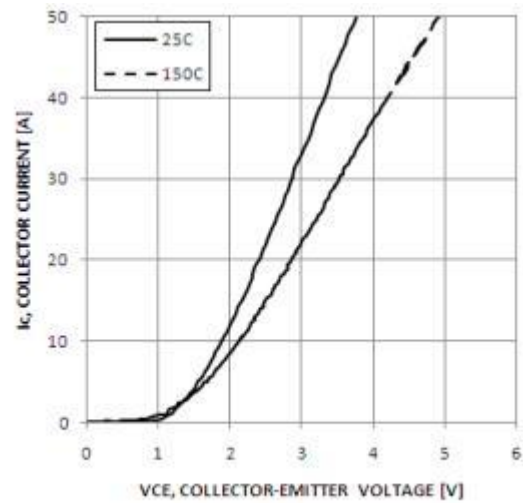


Figure 2. Typical Output Characteristics

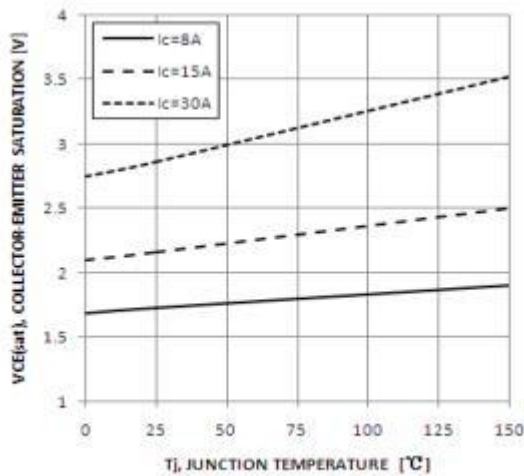


Figure 3. Typical Saturation Voltage vs. Junction Temperature

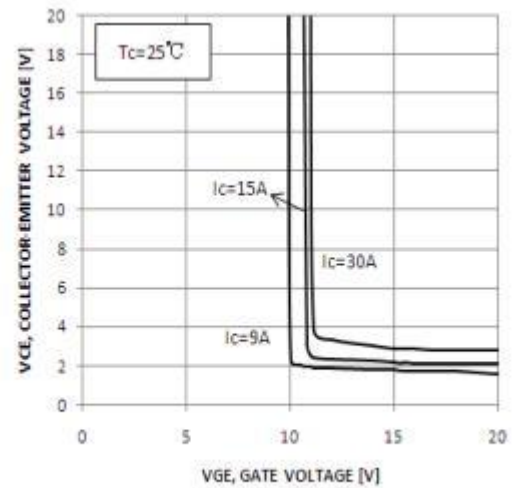


Figure 4. Typical Saturation Voltage vs. Gate- Emitter Voltage

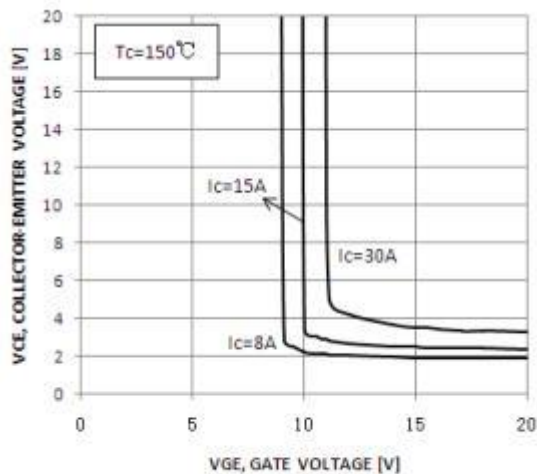


Figure 5. Typical Saturation Voltage vs. Gate-Emitter Voltage

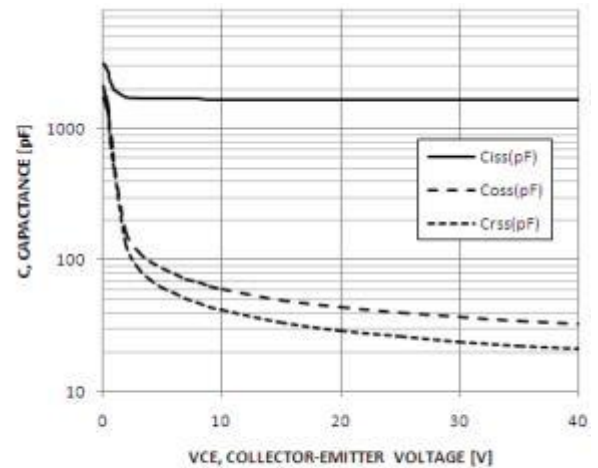


Figure 6. Typical Capacitance Characteristics

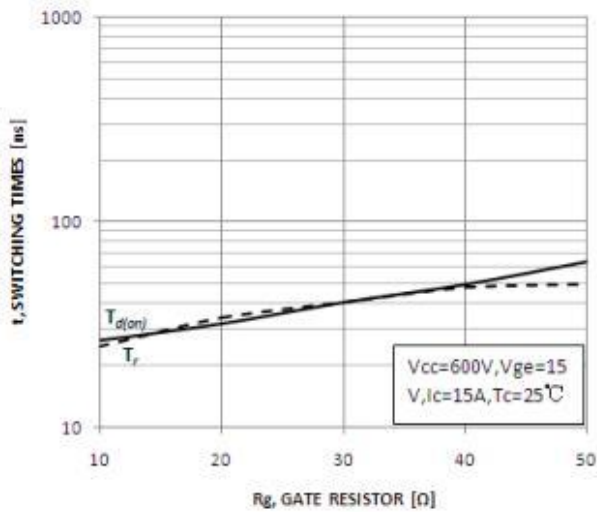


Figure 7. Typical Turn-On Characteristics vs. Gate Resistance

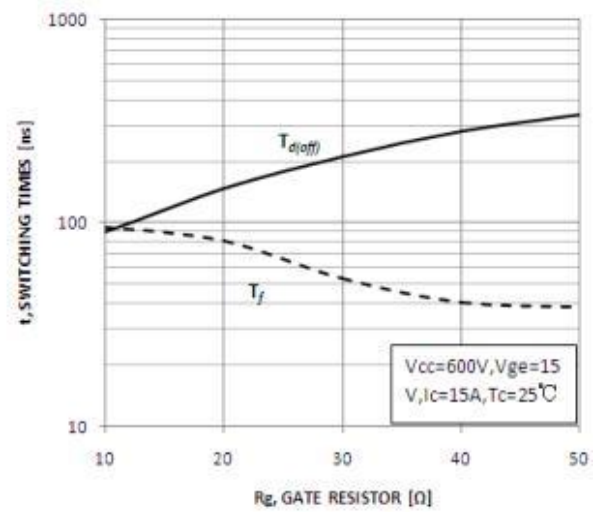


Figure 8. Typical Turn-Off Characteristics vs. Gate

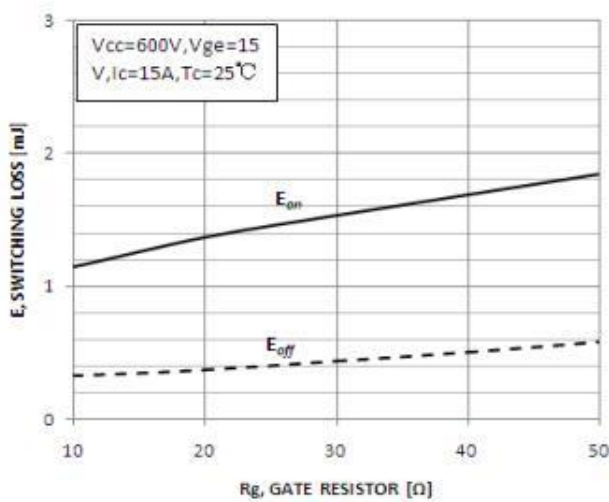


Figure 9. Typical Switching Losses vs. Gate Resistance

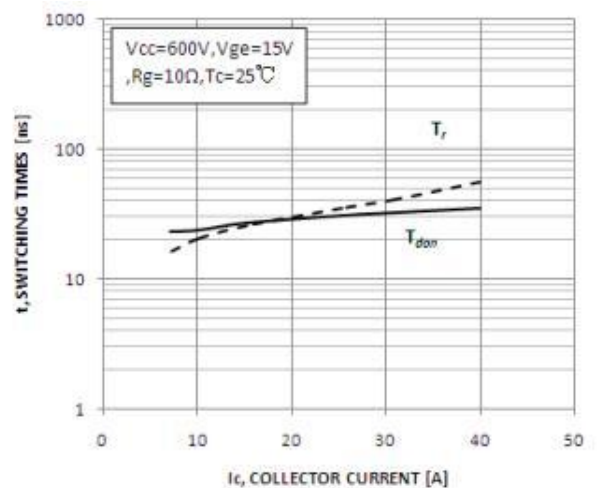


Figure 10. Typical Turn-On Characteristics vs. Collector Current

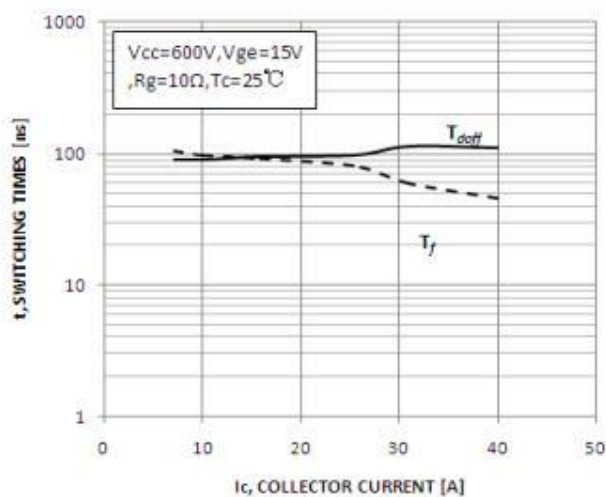


Figure 11. Typical Turn-Off Characteristics vs. Collector Current

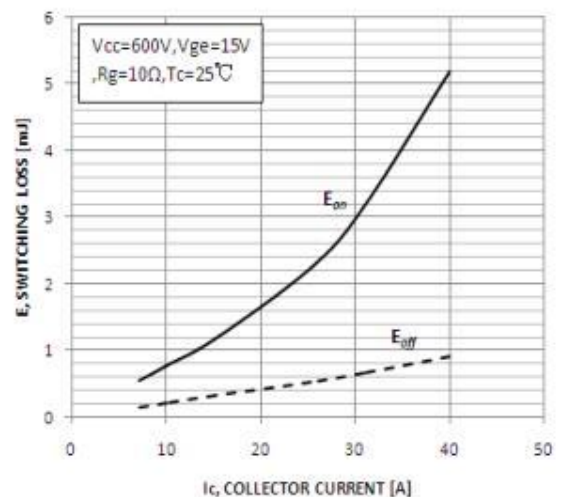


Figure 12. Typical Switching Losses vs. Collector Current

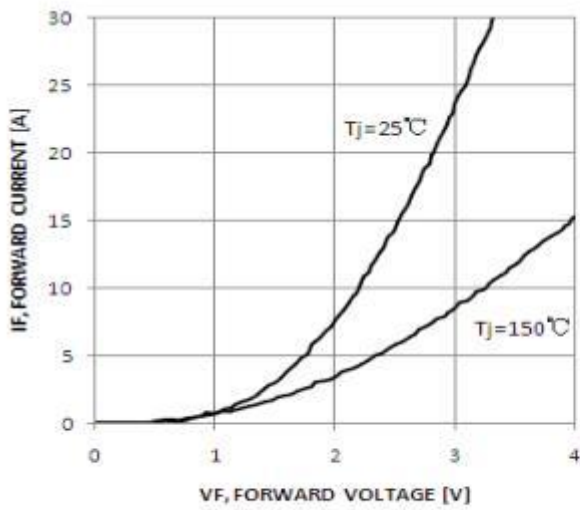


Figure 13. Typical Diode Forward Characteristics

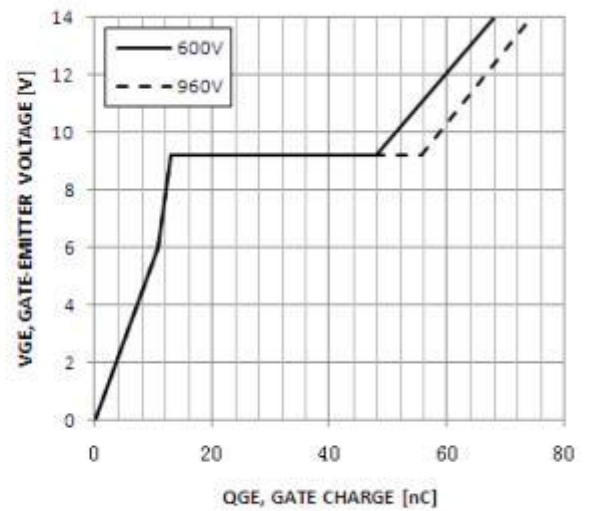


Figure 14. Typical Gate Charge

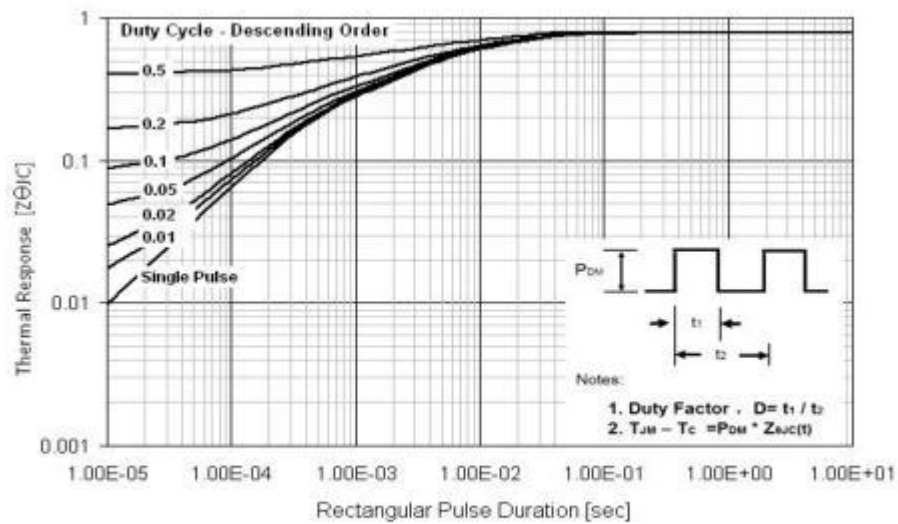
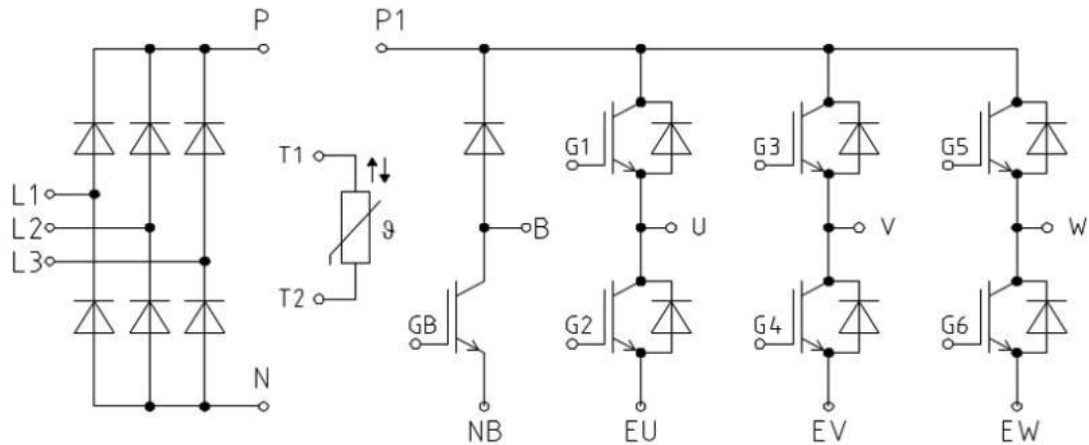


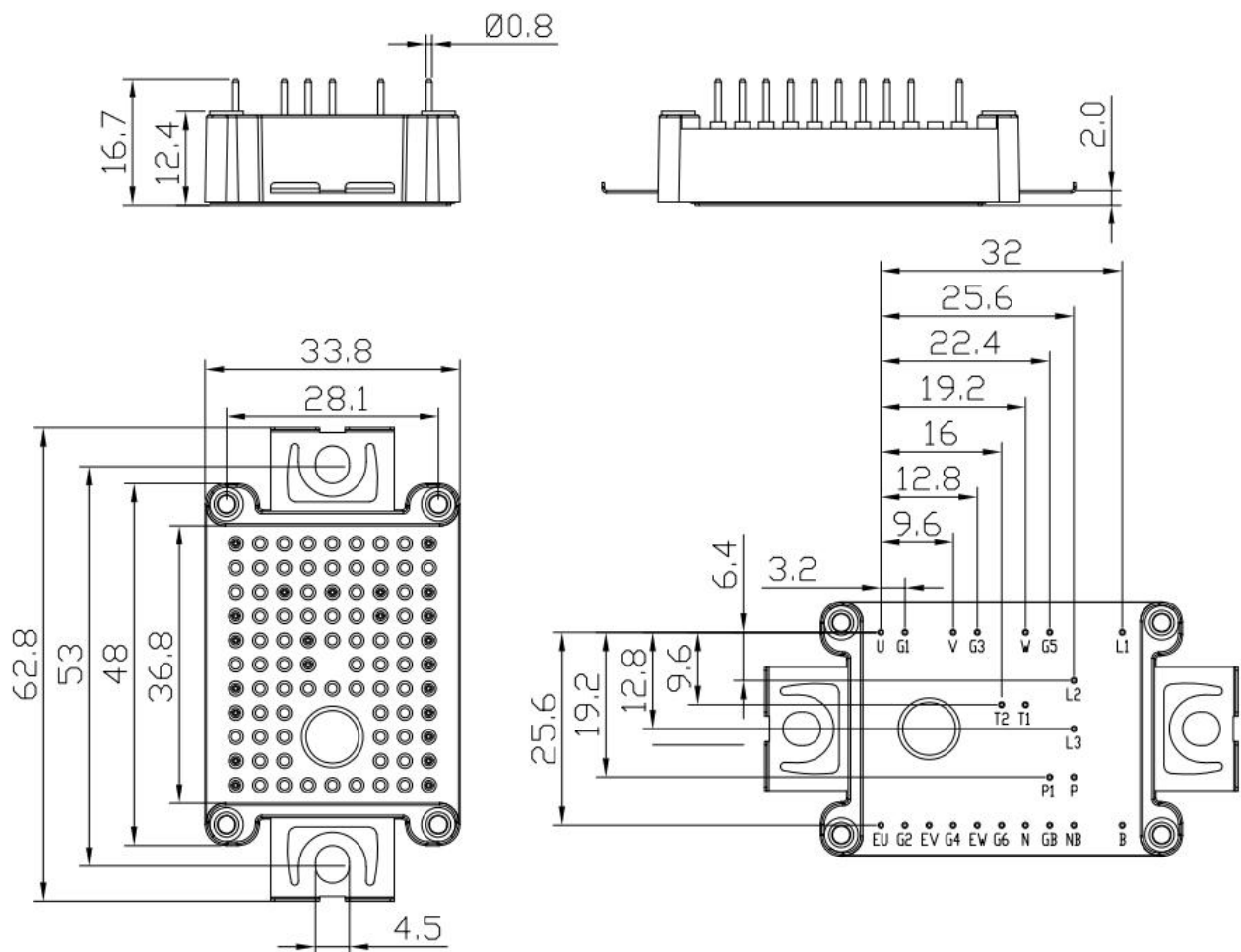
Figure 15. Transient Thermal Impedance of IGBT

Circuit Diagram



Package Dimensions

(Dimensions in Millimeters)



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