LWR400G1207BO
LWR400G1207BU

SUSPM™

1200V 400A Chopper IGBT Module

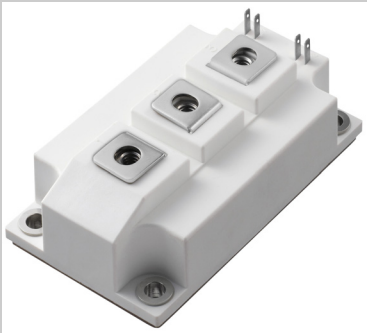
Features

- Trench & Field Stop technology (IGBT4)
  - Low saturation voltage
  - Low turn-off Losses
  - Short tail current
  - Positive temperature coefficient
  - High ruggedness
- Free wheeling diodes with fast and soft reverse recovery
- Industrial standard package with copper base plate

Applications

- Boost, Buck (Power Supply)
- Brake unit / UPS
- Battery charger

Preliminary data



SUSPM3

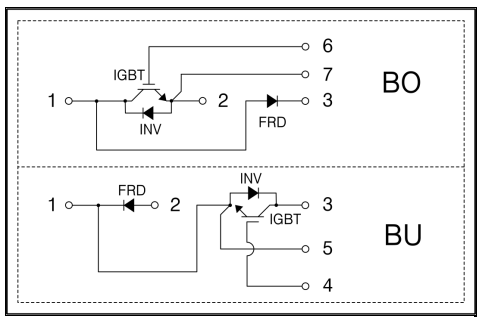
108 x 62 x 29.9 mm

Absolute Maximum Ratings T_C = 25°C unless otherwise noted

Item	Symbol	Conditions	Value	Units
IGBT	V_{CES}		1200	V
	V_{GES}		± 20	V
	I_C	@T_j = 175 °C, T_C = 25 °C, Continuous	-	A
		@T_j = 175 °C, T_C = 80 °C, Continuous	400	A
	I_{CM}	@T_C = 80 °C, t_P = 1ms	800	A
	T_{SC}	Chip Level, @T_j = 150 °C, V_{GE} = 15 V, V_{CES} < 600 V	10	μs
	T_j	Operating Junction Temperature *(1)	-40~125	°C
	P_D	@T_j = 175°C, T_C = 25 °C	2200	W
		@T_j = 175 °C, T_C = 80 °C	1400	W
Inverse Diode	V_{RRM}		1200	V
	I_F		300	A
	I_{FRM}	t_P = 1 ms	600	A
	T_j	Operating Junction Temperature *(1)	-40~125	°C
Free-wheeling Diode	V_{RRM}		1200	V
	I_F		400	A
	I_{FRM}	t_P = 1 ms	800	A
	T_j	Operating Junction Temperature *(2)	-40~125	°C
Module	T_{stg}	Storage Temperature	-40~125	°C
	V_{iso}	@ AC 1 minute	2500	V
	M_t	Main Terminal Mounting torque (M6)	2.5~6.0	Nm
	M_S	Heat sink Mounting torque (M6)	3.0~6.0	Nm
	W	Weight	350	g

Internal Circuit & Pin Description

Pin Number	Pin Name	Pin Description
1	C2E1	Out
2	E2	Negative DC Link Output
3	C1	Positive DC Link Output
4	G1	Gate Input for High-side
5	E1	Emitter Input for High-side
6	G2	Gate Input for Low-side
7	E2	Emitter Input for Low-side



(Note *1) The Maximum junction temperature of chip is 175 °C.
(Note *2) The Maximum junction temperature of chip is 150 °C.

Electrical Characteristics of IGBT and Diodes T_C = 25°C unless otherwise noted

Static Characteristics of IGBT

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
BV_{CES}	C-E Breakdown Voltage	V_{GE} = 0 V, I_C = 1 mA	1200	-	-	V
I_{CES}	C-E Cut-Off Current	V_{CE} = V_{CES}, V_{GE} = 0 V	-	-	1	mA
I_{GES}	G-E Leakage Current	V_{GE} = V_{GES}, V_{CE} = 0 V	-	-	-	nA
$V_{GE(th)}$	G-E Threshold Voltage	V_{GE} = V_{CE}, I_C = 400 mA	-	6.5	-	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C = 400 A, V_{GE} = 15 V, T_C = 25 °C	-	2.0	-	V
		I_C = 400 A, V_{GE} = 15 V, T_C = 125 °C	-	2.5	-	V

Dynamic Characteristics of IGBT

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_{ies}	Input Capacitance	V_{CE} = 25 V, V_{GE} = 0 V f = 1 MHz, T_C = 25 °C	-	27.2	-	nF
C_{oes}	Output Capacitance		-	1.8	-	nF
C_{res}	Reverse Transfer Capacitance		-	1.5	-	nF
t_d(on)	Turn-On Delay Time	T_C = 125 °C, R_G = 1.8 Ω L = 25 μH, V_{DC} = 600 V V_{GE} = 15 V ~ -15 V I_C = 400 A	-	184	-	ns
t_r	Rise Time		-	78	-	ns
t_d(off)	Turn-Off Delay Time		-	649	-	ns
t_f	Fall Time		-	219	-	ns
E_{on}	Turn-On Switching Loss		-	46.3	-	mJ
E_{off}	Turn-Off Switching Loss		-	45.5	-	mJ
E_{ts}	Total Switching Loss		-	91.8	-	mJ
Q_g	Total Gate Charge	V_{GE} = 0 V ~ +15 V	-	1.95	-	μC
Q_{ge}	Gate-Emitter Charge		-	0.26	-	μC
Q_{gc}	Gate-Collector Charge		-	1.12	-	μC

Electrical Characteristics of INV(Inverse Diode)

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
V_F	Diode Forward Voltage	I_F = 400 A	T_C = 125 °C	-	2.5	-	V
t_{rr}	Diode Reverse Recovery Time	R_G = 1.8 Ω L = 25 μH V_{DC} = 600 V V_{GE} = 15 V ~ -15 V I_C = 400 A	T_C = 125 °C	-	629	-	ns
I_{RRM}	Diode Peak Reverse Recovery Current		T_C = 125 °C	-	376	-	A
Q_{rr}	Diode Reverse Recovery Charge		T_C = 125 °C	-	80	-	μC
E_{rr}	Diode Reverse Recovery Energy		T_C = 125 °C	-	30.9	-	mJ

Electrical Characteristics of FRD(Free-wheeling Diode)

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
V_F	Diode Forward Voltage	I_F = 400 A	T_C = 125 °C	-	1.9	-	V
t_{rr}	Diode Reverse Recovery Time	R_G = 1.8 Ω L = 25 μH V_{DC} = 600 V V_{GE} = 15 V ~ -15 V I_F = 400 A	T_C = 125 °C	-	754	-	ns
I_{RRM}	Diode Peak Reverse Recovery Current		T_C = 125 °C	-	468	-	A
Q_{rr}	Diode Reverse Recovery Charge		T_C = 125 °C	-	113	-	μC
E_{rr}	Diode Reverse Recovery Energy		T_C = 125 °C	-	48.2	-	mJ

Thermal Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$R_{th(J-C)}$	Thermal Resistance (IGBT)	Junction-to-Case	-	0.066	-	°C/W
$R_{th(J-C)}$	Thermal Resistance (INV Diode)	Junction-to-Case	-	0.162	-	°C/W
$R_{th(J-C)}$	Thermal Resistance (FRD Diode)	Junction-to-Case	-	0.104	-	°C/W

* This specifications may not be considered as an assurance of characteristics and may not have same characteristics in case of using different test systems from @ LSIS. We therefore strongly recommend prior consultation of our engineers.

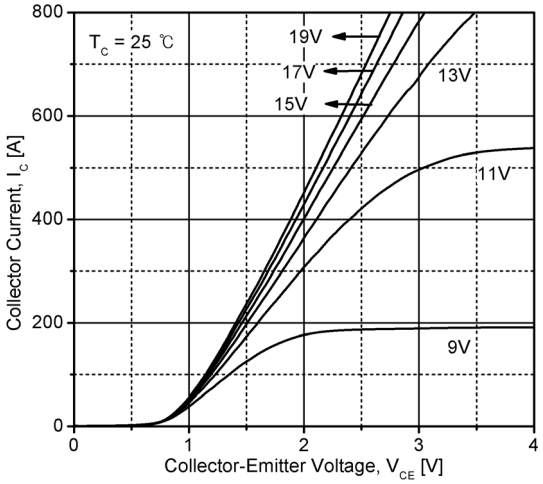


Fig 1. Typical IGBT Output Characteristics

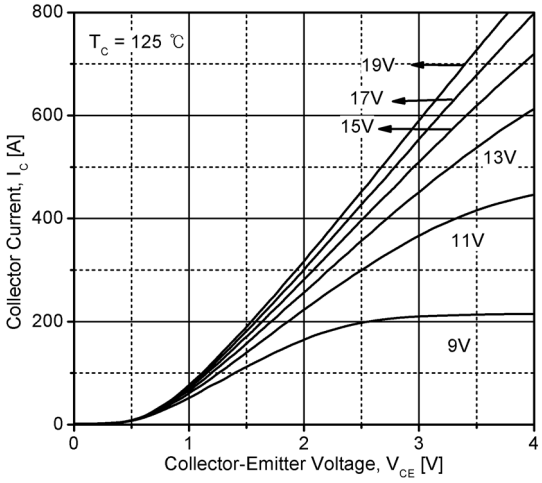


Fig 2. Typical IGBT Output Characteristics

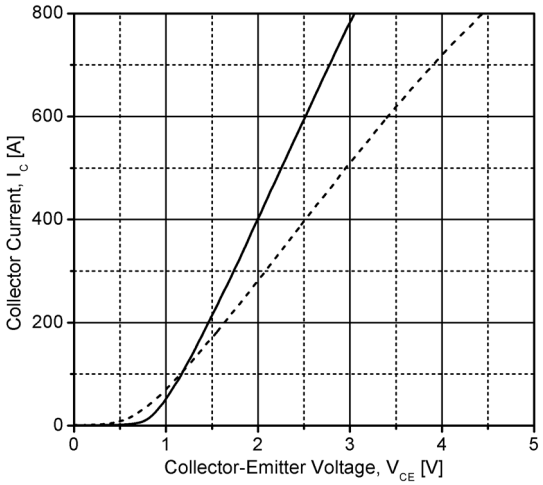


Fig 3. Typical IGBT Output Characteristics

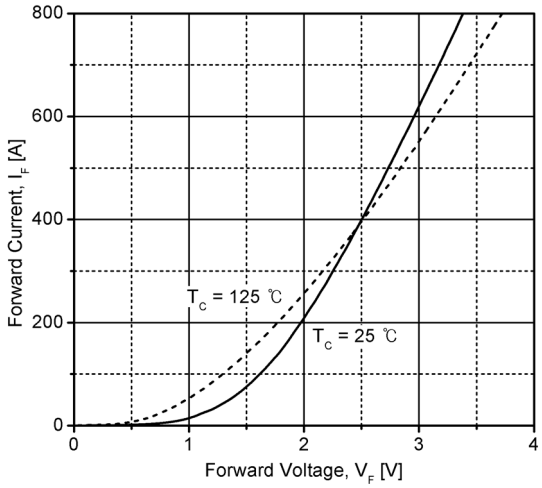


Fig 4. Typical Inverse Diode Characteristics

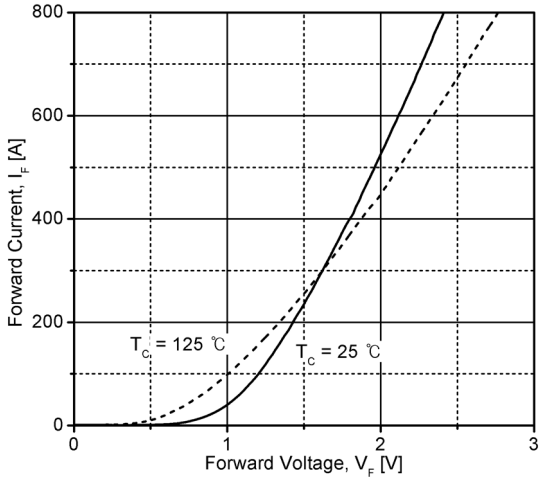


Fig 5. Typical Free-wheeling Diode Characteristics

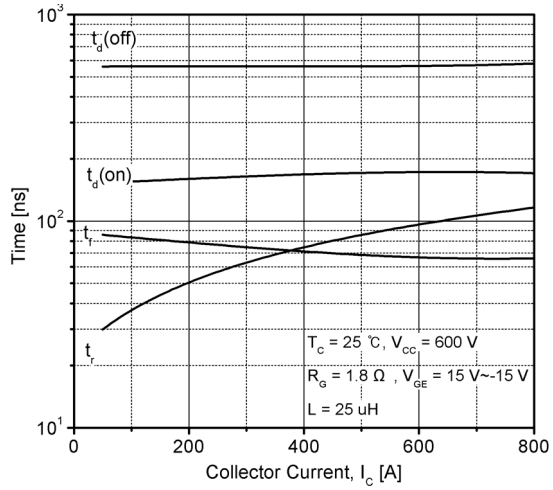


Fig 6. Typical Switching Time vs. Collector Current

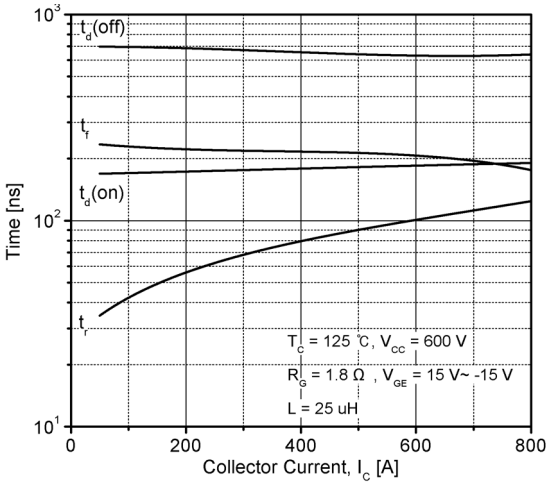


Fig 7. Typical Switching Time vs. Collector Current

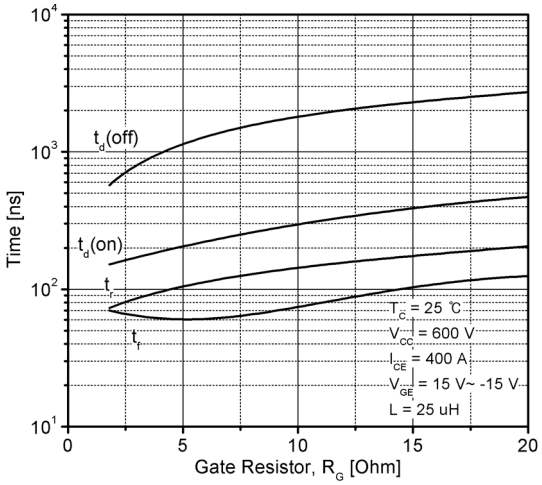


Fig 8. Typical Switching Time vs. Gate Resistor

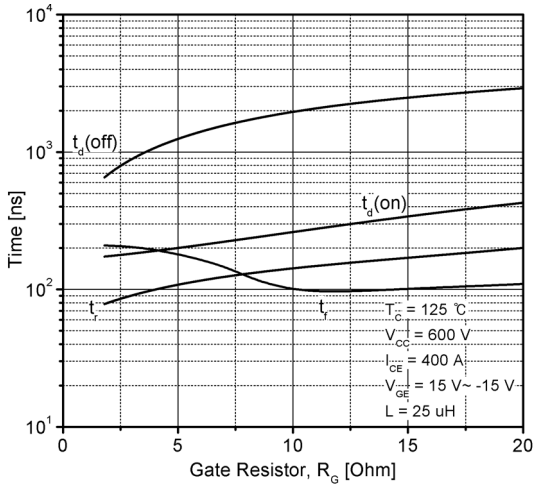


Fig 9. Typical Switching Time vs. Gate Resistor

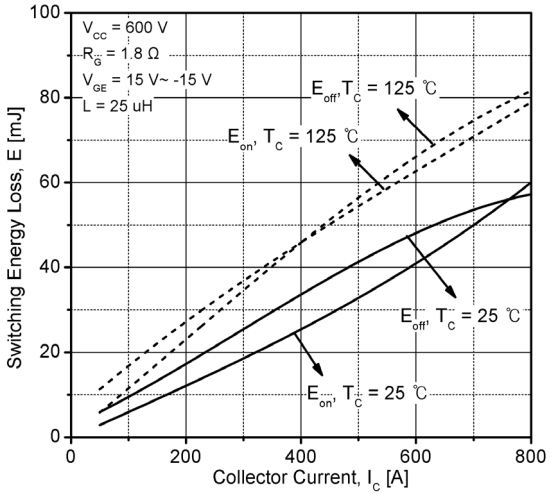


Fig 10. Typical IGBT Switching Loss

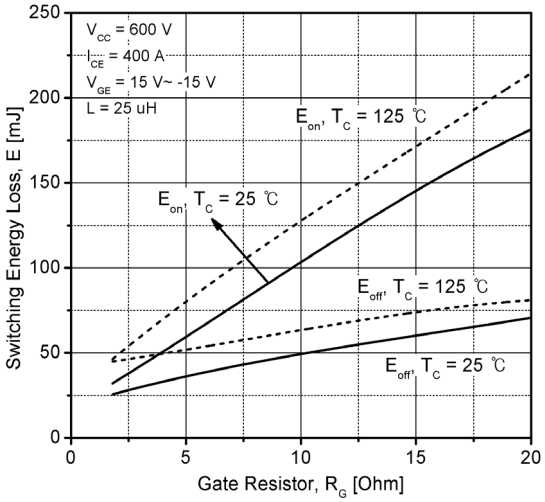


Fig 11. Typical IGBT Switching Loss

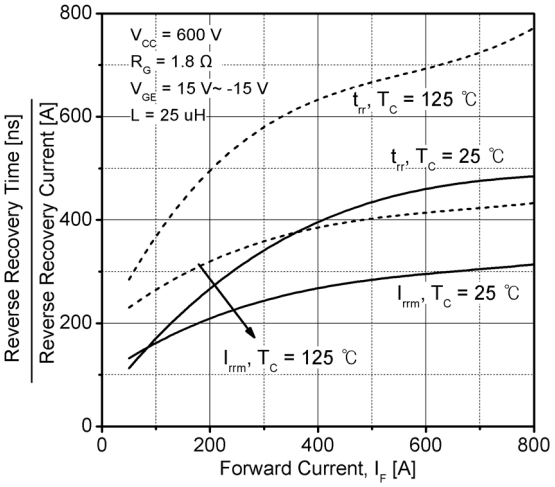


Fig 12. Typical Recovery of Inverse Diode

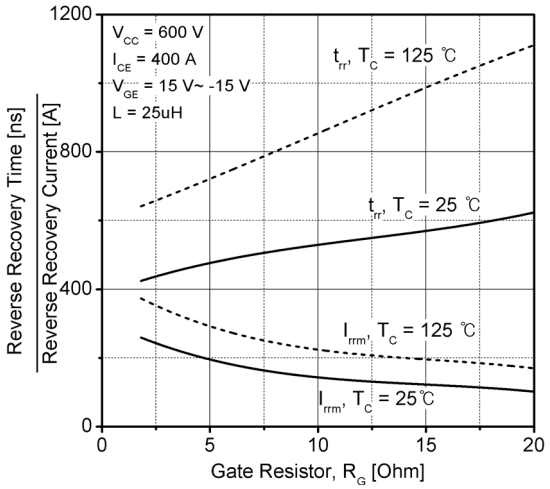


Fig 13. Typical Recovery of Inverse Diode

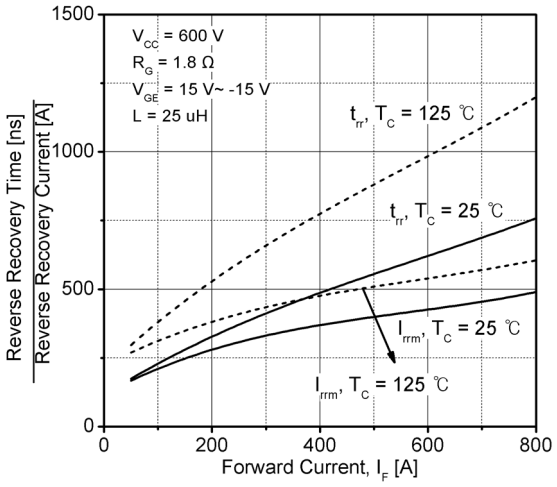


Fig 14. Typical Recovery of Free-wheeling Diode

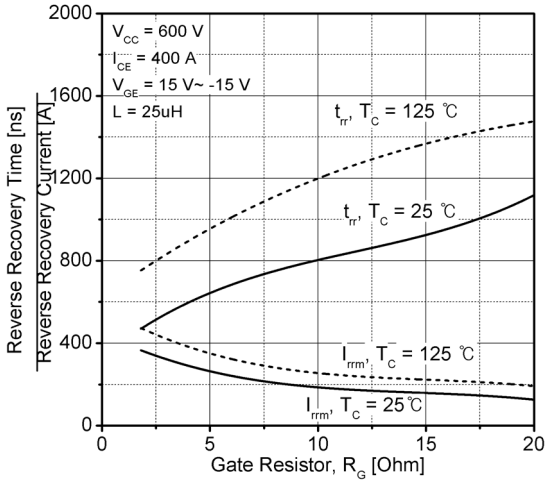


Fig 15. Typical Recovery of Free-wheeling Diode

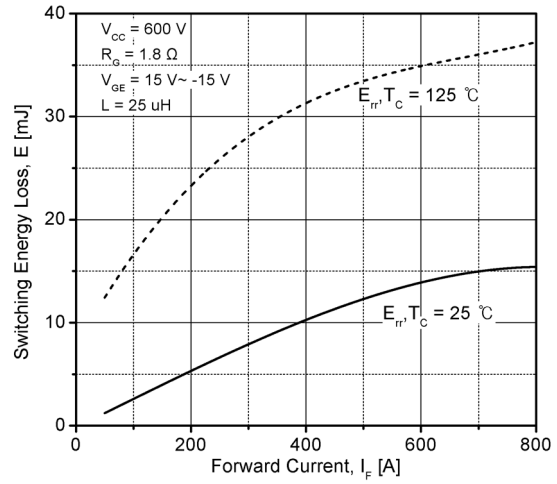


Fig 16. Typical Inverse Diode Switching Loss

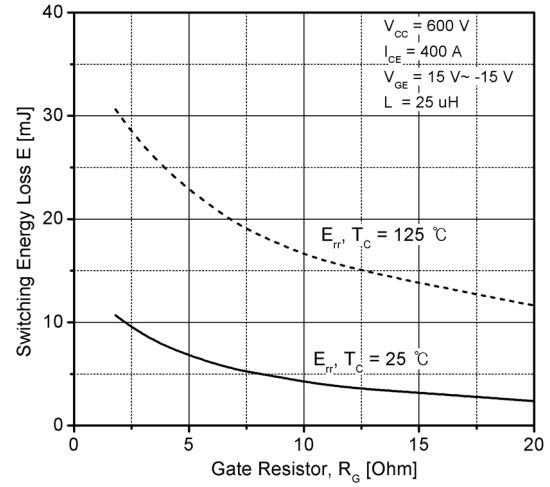


Fig 17. Typical Inverse Diode Switching Loss

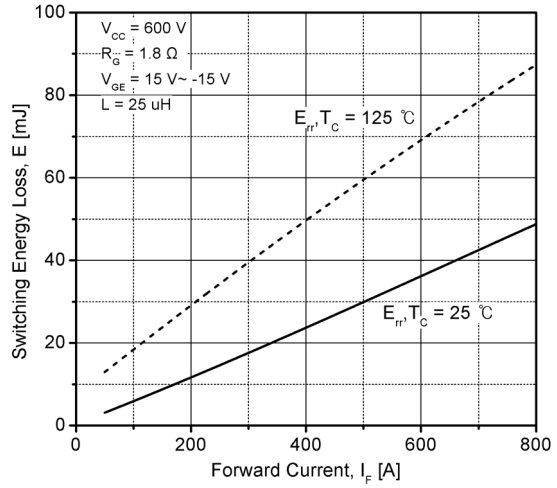


Fig 18. Typical Free-wheeling Diode Switching Loss

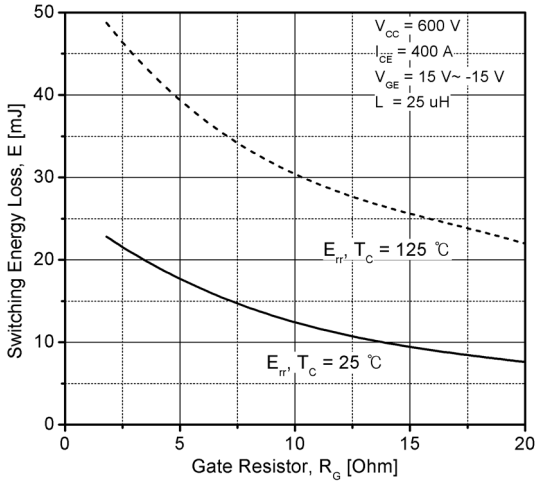


Fig 19. Typical Free-wheeling Diode Switching Loss

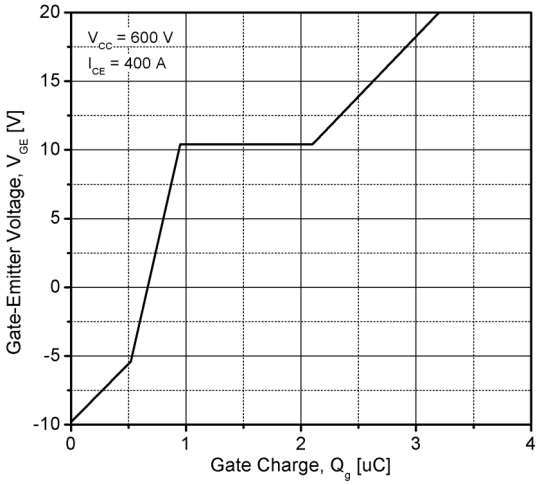


Fig 20. Typical Gate Charge Characteristics

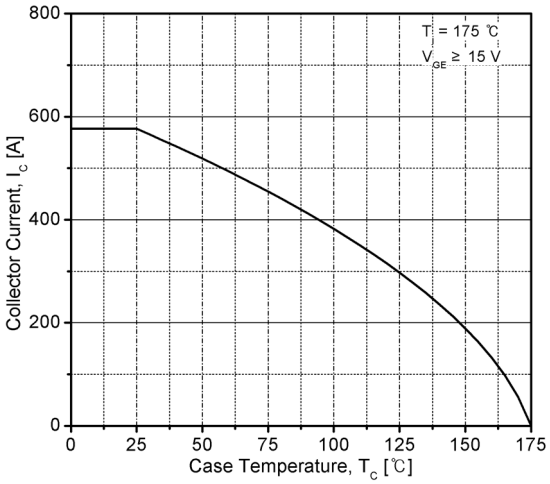


Fig 21. Case Temp vs. Collector Current

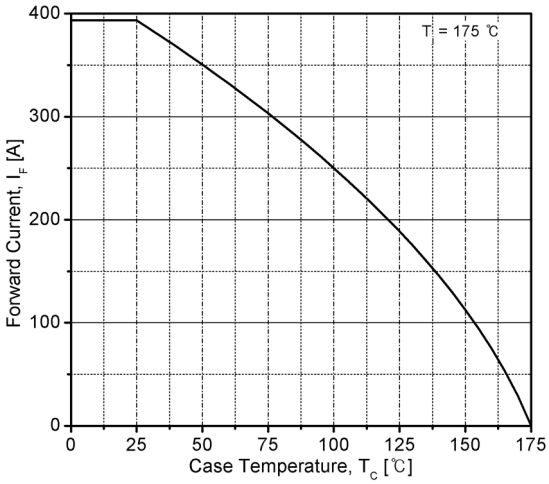


Fig 22. Case Temp vs. Inverse Diode Current

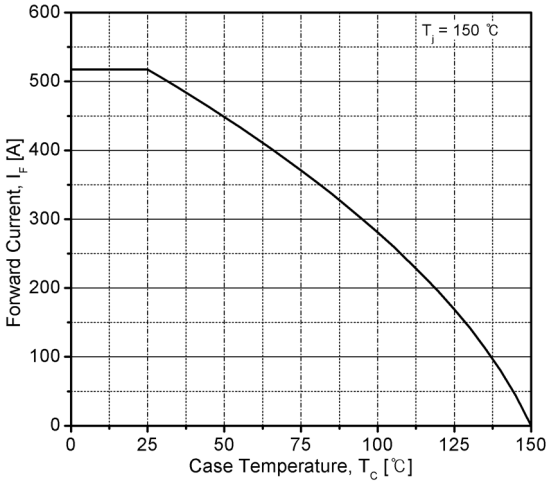


Fig 23. Case Temp vs. Free-wheeling Diode Current

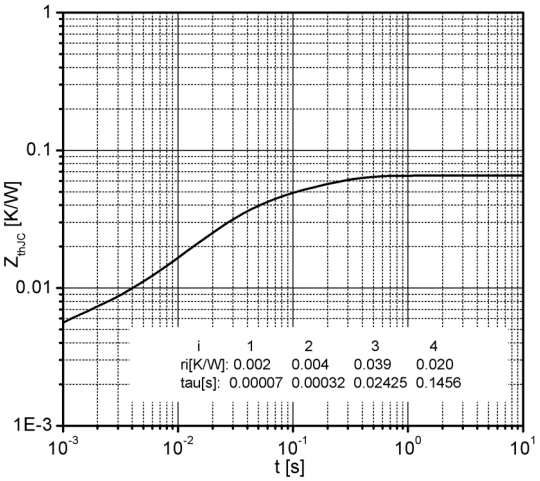


Fig 24. Typical IGBT Thermal Impedance

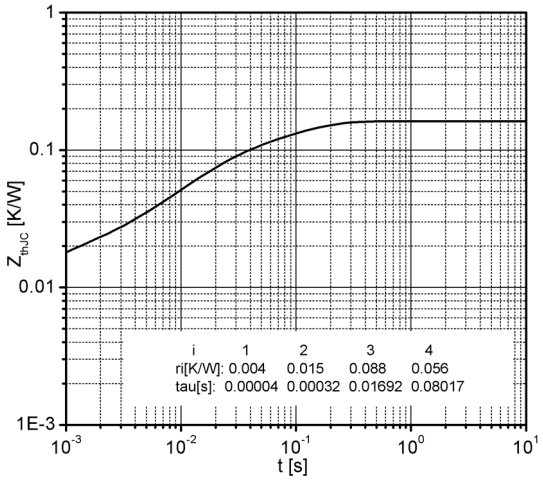


Fig 25. Typical Inverse Diode Thermal Impedance

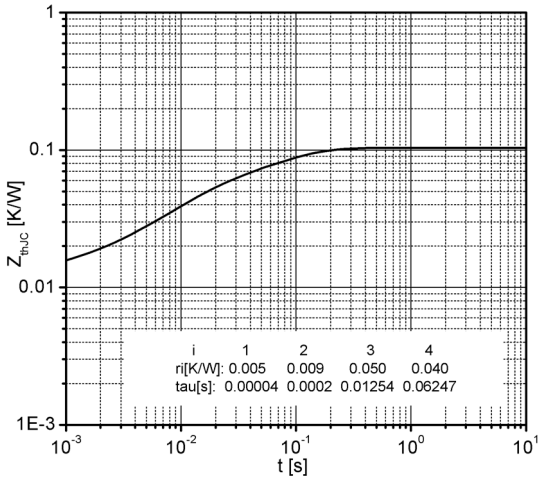
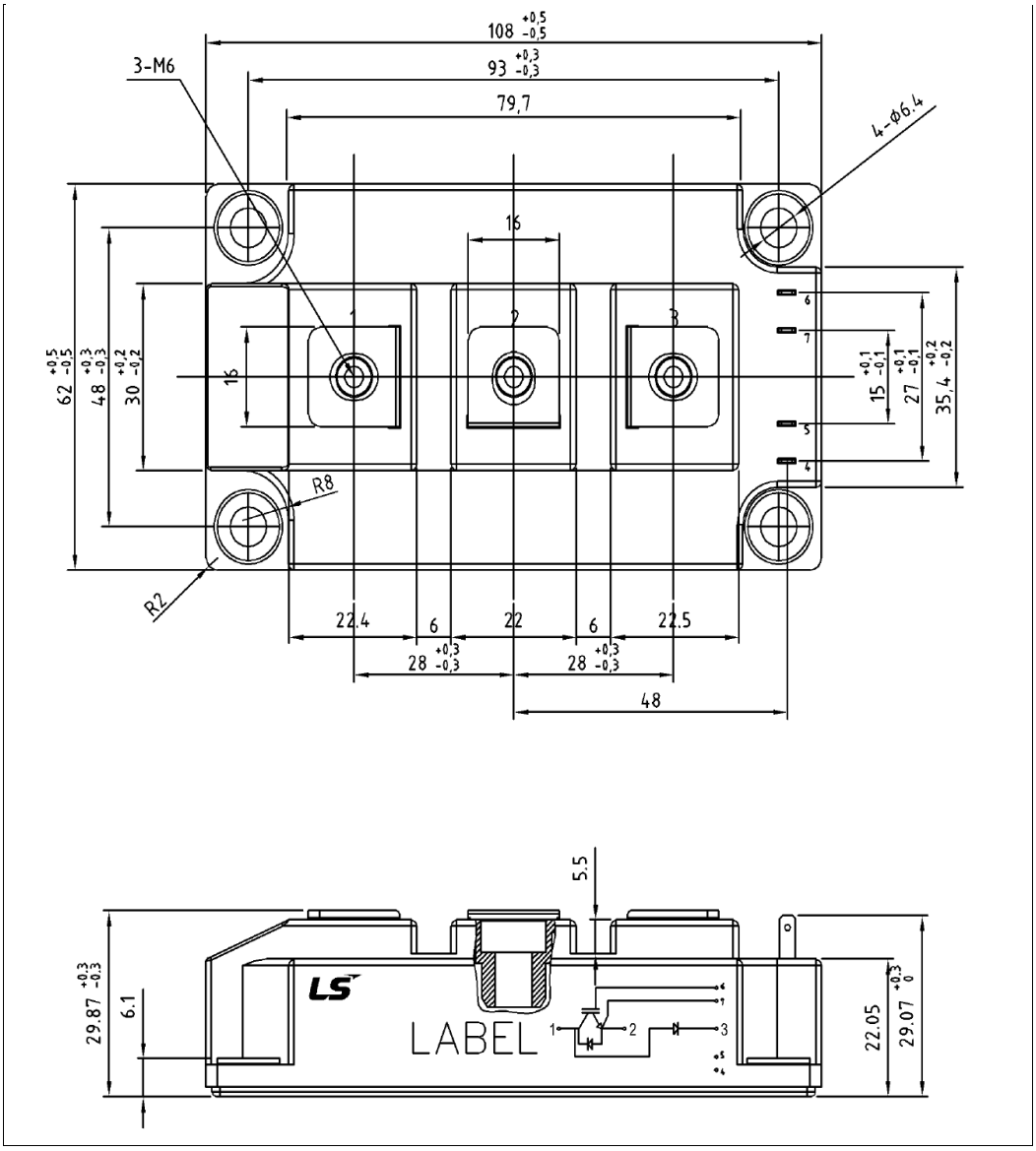


Fig 26. Free-Wheeling Diode Thermal Impedance

Package Dimension (Dimension in mm)



Circuit Description