

**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**



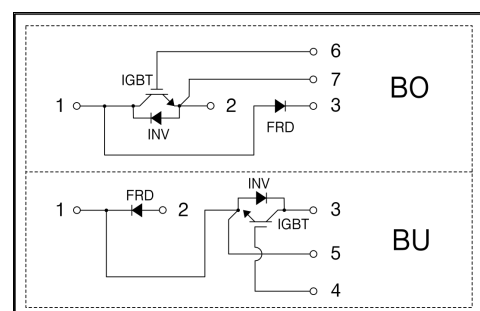
**Absolute Maximum Ratings**  $T_C = 25^\circ\text{C}$  unless otherwise noted

Item	Symbol	Conditions	Value	Units
IGBT	$V_{CES}$		1200	V
	$V_{GES}$		$\pm 20$	V
	$I_C$	@ $T_j = 175^\circ\text{C}$ , $T_C = 25^\circ\text{C}$ , Continuous	-	A
		@ $T_j = 175^\circ\text{C}$ , $T_C = 80^\circ\text{C}$ , Continuous	400	A
	$I_{CM}$	@ $T_C = 80^\circ\text{C}$ , $t_p = 1\text{ms}$	800	A
	$T_{SC}$	Chip Level, @ $T_j = 150^\circ\text{C}$ , $V_{GE} = 15\text{V}$ , $V_{CES} < 600\text{V}$	10	$\mu\text{s}$
	$T_j$	Operating Junction Temperature <sup>(1)</sup>	-40~125	$^\circ\text{C}$
	$P_D$	@ $T_j = 175^\circ\text{C}$ , $T_C = 25^\circ\text{C}$	2200	W
@ $T_j = 175^\circ\text{C}$ , $T_C = 80^\circ\text{C}$		1400	W	
Inverse Diode	$V_{RRM}$		1200	V
	$I_F$		300	A
	$I_{FRM}$	$t_p = 1\text{ms}$	600	A
	$T_j$	Operating Junction Temperature <sup>(1)</sup>	-40~125	$^\circ\text{C}$
Free-wheeling Diode	$V_{RRM}$		1200	V
	$I_F$		400	A
	$I_{FRM}$	$t_p = 1\text{ms}$	800	A
	$T_j$	Operating Junction Temperature <sup>(2)</sup>	-40~125	$^\circ\text{C}$
Module	$T_{stg}$	Storage Temperature	-40~125	$^\circ\text{C}$
	$V_{iso}$	@ 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  $175^\circ\text{C}$ .  
(Note \*2) The Maximum junction temperature of chip is  $150^\circ\text{C}$ .



## Electrical Characteristics of IGBT and Diodes $T_C = 25^\circ\text{C}$ unless otherwise noted

### Static Characteristics of IGBT

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

### Dynamic Characteristics of IGBT

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$C_{ies}$	Input Capacitance	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$ $f = 1\text{ MHz}, T_C = 25^\circ\text{C}$	-	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	$T_C = 125^\circ\text{C}, R_G = 1.8\ \Omega$ $L = 25\ \mu\text{H}, V_{DC} = 600\text{ V}$ $V_{GE} = 15\text{ V} \sim -15\text{ V}$ $I_C = 400\text{ A}$	-	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	$V_{GE} = 0\text{ V} \sim +15\text{ V}$	-	1.95	-	$\mu\text{C}$
$Q_{ge}$	Gate-Emitter Charge		-	0.26	-	$\mu\text{C}$
$Q_{gc}$	Gate-Collector Charge		-	1.12	-	$\mu\text{C}$

### Electrical Characteristics of INV(Inverse Diode)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_F$	Diode Forward Voltage	$I_F = 400\text{ A}$ $T_C = 125^\circ\text{C}$	-	2.5	-	V
$t_{rr}$	Diode Reverse Recovery Time	$R_G = 1.8\ \Omega$ $T_C = 125^\circ\text{C}$	-	629	-	ns
$I_{RRM}$	Diode Peak Reverse Recovery Current	$L = 25\ \mu\text{H}$ $V_{DC} = 600\text{ V}$ $T_C = 125^\circ\text{C}$	-	376	-	A
$Q_{rr}$	Diode Reverse Recovery Charge	$V_{GE} = 15\text{ V} \sim -15\text{ V}$ $T_C = 125^\circ\text{C}$	-	80	-	$\mu\text{C}$
$E_{rr}$	Diode Reverse Recovery Energy	$I_C = 400\text{ A}$ $T_C = 125^\circ\text{C}$	-	30.9	-	mJ

### Electrical Characteristics of FRD(Free-wheeling Diode)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_F$	Diode Forward Voltage	$I_F = 400\text{ A}$ $T_C = 125^\circ\text{C}$	-	1.9	-	V
$t_{rr}$	Diode Reverse Recovery Time	$R_G = 1.8\ \Omega$ $T_C = 125^\circ\text{C}$	-	754	-	ns
$I_{RRM}$	Diode Peak Reverse Recovery Current	$L = 25\ \mu\text{H}$ $V_{DC} = 600\text{ V}$ $T_C = 125^\circ\text{C}$	-	468	-	A
$Q_{rr}$	Diode Reverse Recovery Charge	$V_{GE} = 15\text{ V} \sim -15\text{ V}$ $T_C = 125^\circ\text{C}$	-	113	-	$\mu\text{C}$
$E_{rr}$	Diode Reverse Recovery Energy	$I_F = 400\text{ A}$ $T_C = 125^\circ\text{C}$	-	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	-	$^\circ\text{C/W}$
$R_{th(J-C)}$	Thermal Resistance (INV Diode)	Junction-to-Case	-	0.162	-	$^\circ\text{C/W}$
$R_{th(J-C)}$	Thermal Resistance (FRD Diode)	Junction-to-Case	-	0.104	-	$^\circ\text{C/W}$

\* 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.

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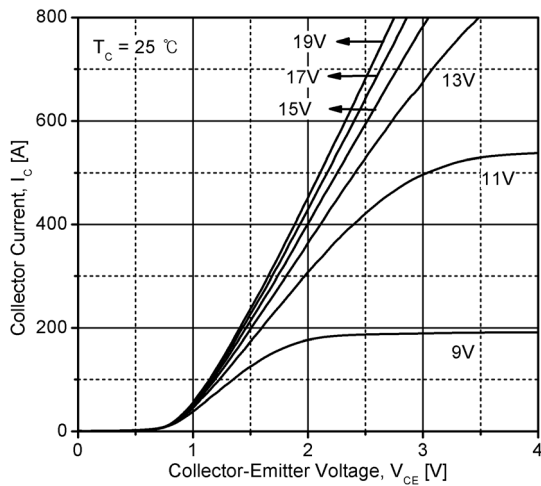


Fig 1. Typical IGBT Output Characteristics

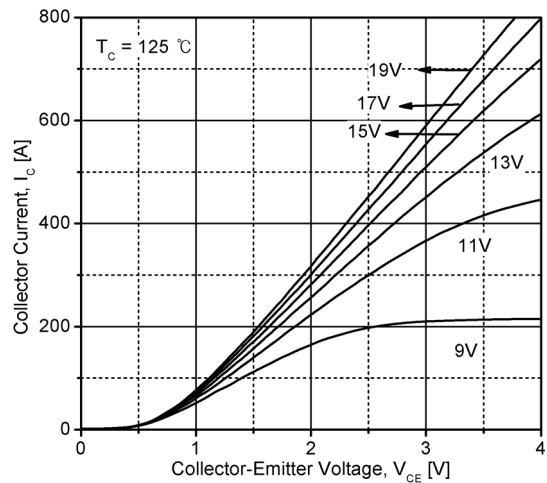


Fig 2. Typical IGBT Output Characteristics

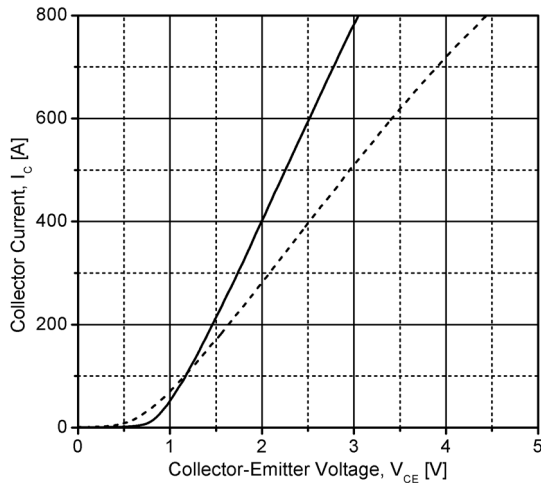


Fig 3. Typical IGBT Output Characteristics

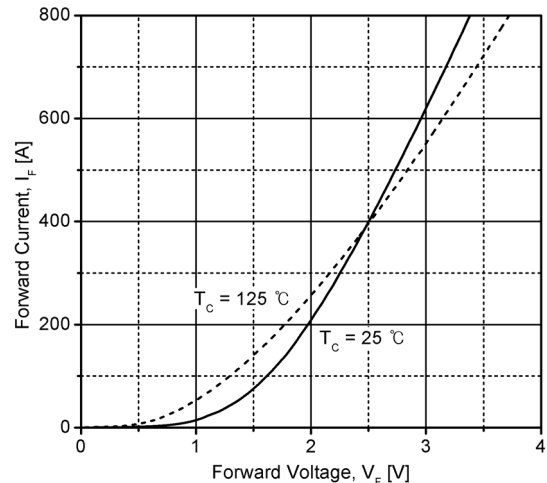


Fig 4. Typical Inverse Diode Characteristics

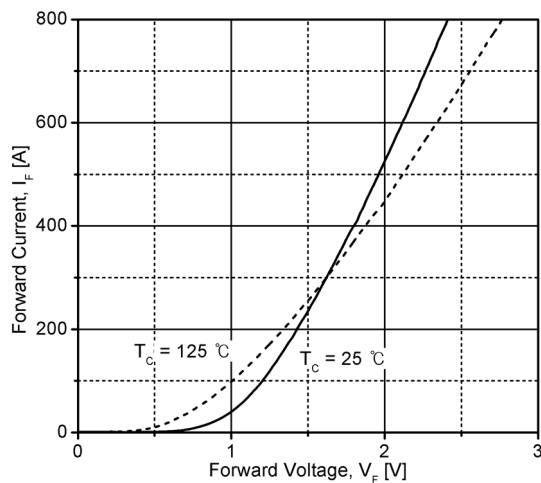


Fig 5. Typical Free-wheeling Diode Characteristics

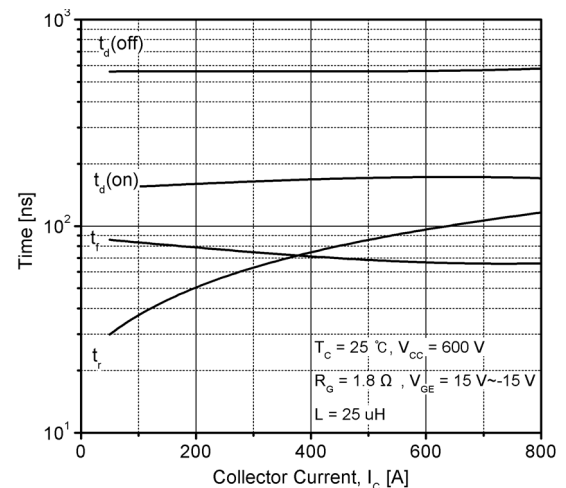


Fig 6. Typical Switching Time vs. Collector Current

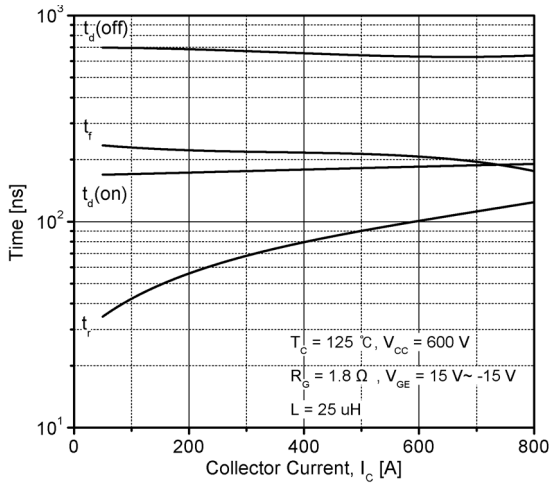


Fig 7. Typical Switching Time vs. Collector Current

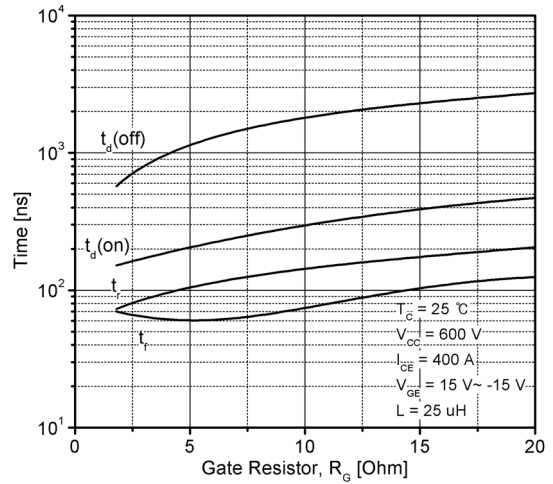


Fig 8. Typical Switching Time vs. Gate Resistor

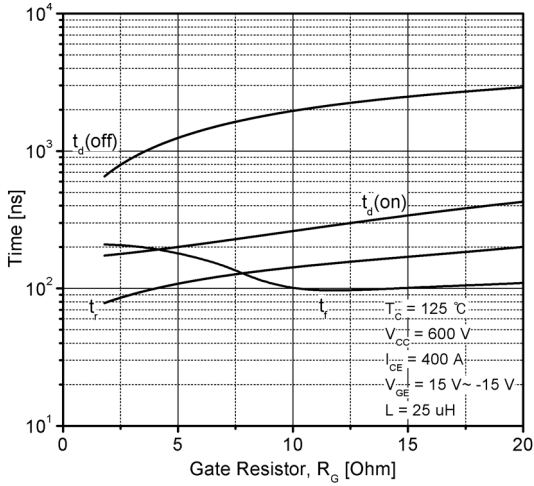


Fig 9. Typical Switching Time vs. Gate Resistor

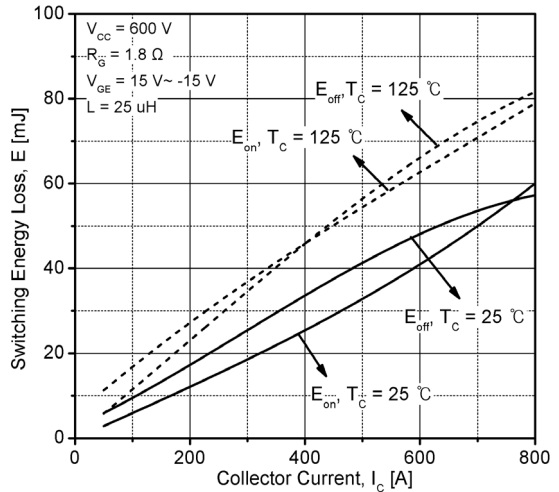


Fig 10. Typical IGBT Switching Loss

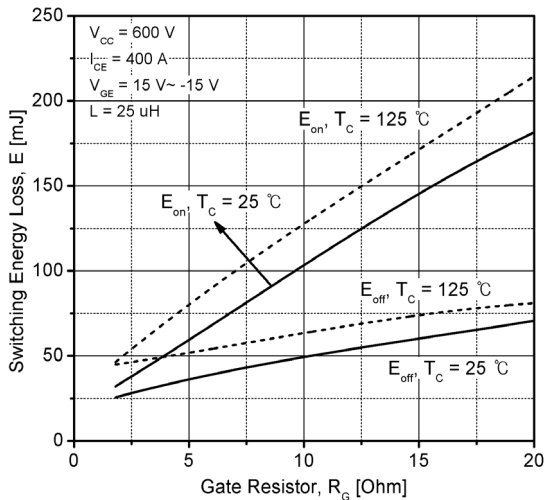


Fig 11. Typical IGBT Switching Loss

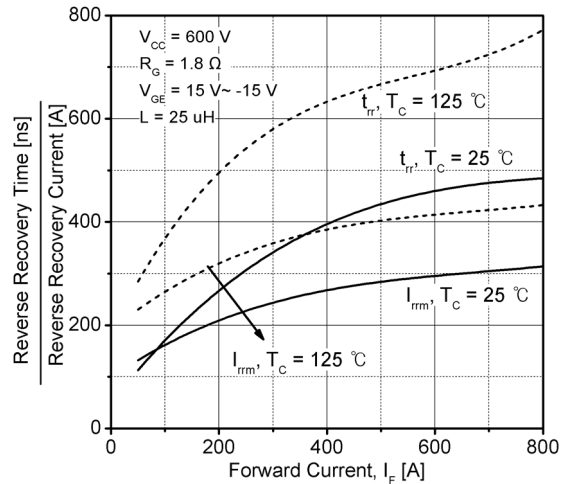


Fig 12. Typical Recovery of Inverse Diode

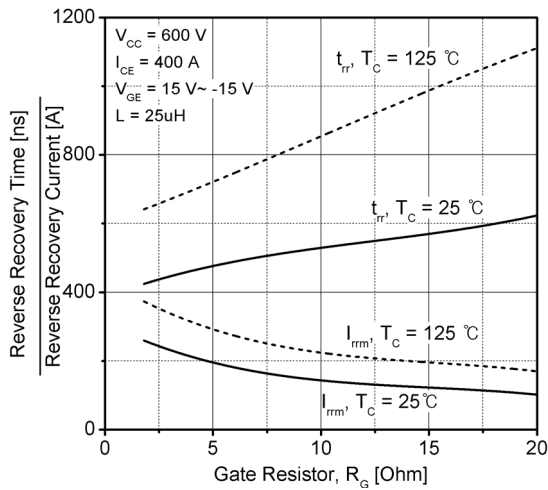


Fig 13. Typical Recovery of Inverse Diode

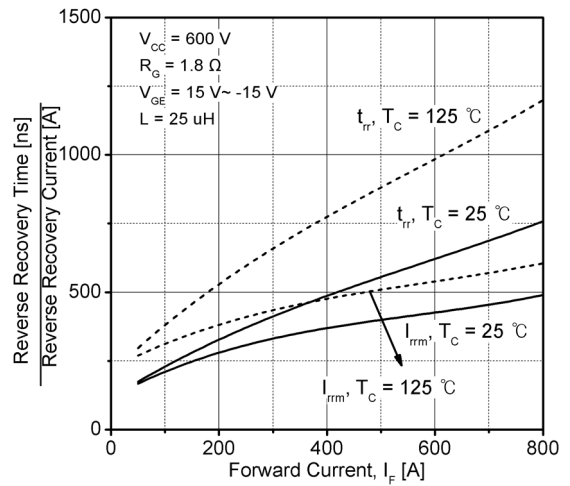


Fig 14. Typical Recovery of Free-wheeling Diode

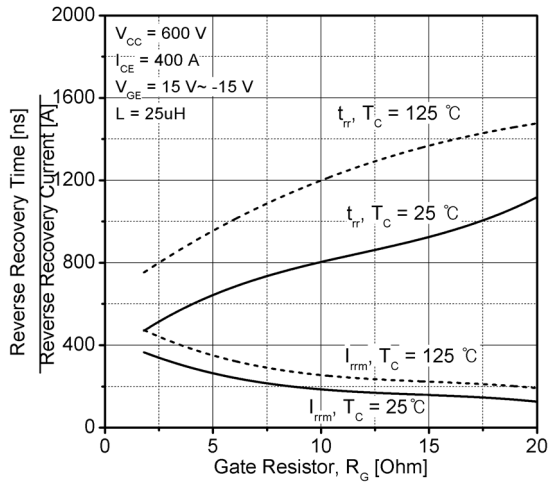


Fig 15. Typical Recovery of Free-wheeling Diode

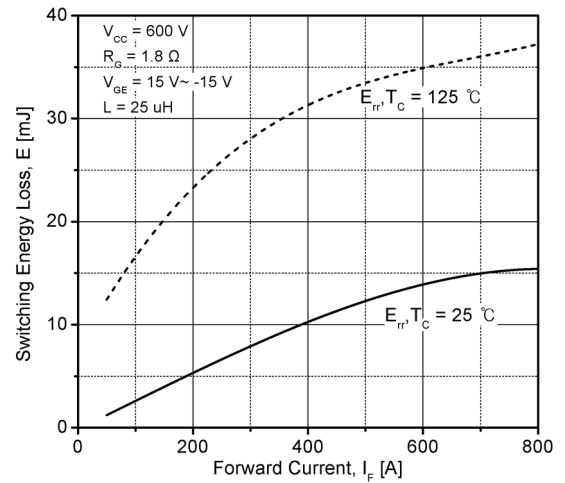


Fig 16. Typical Inverse Diode Switching Loss

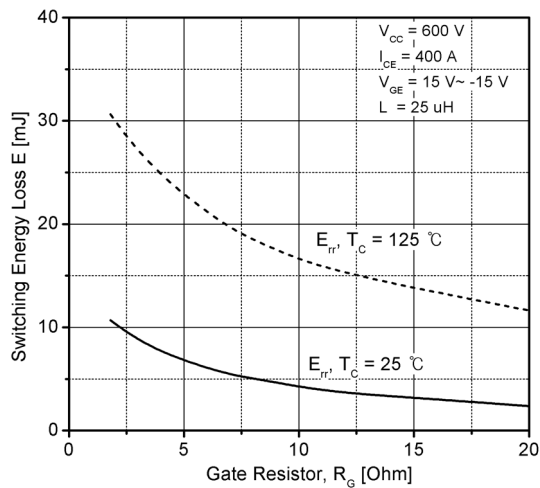


Fig 17. Typical Inverse Diode Switching Loss

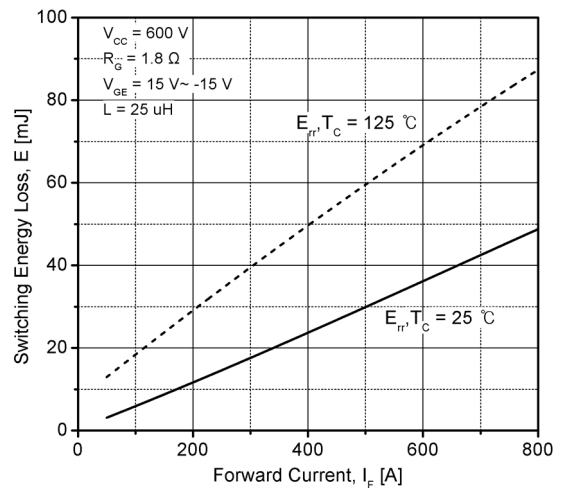


Fig 18. Typical Free-wheeling Diode Switching Loss

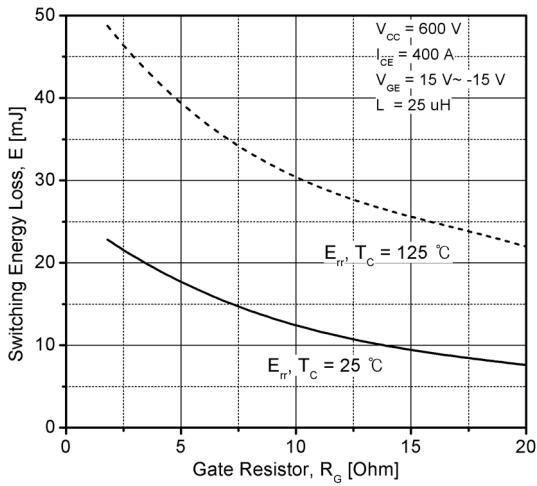


Fig 19. Typical Free-wheeling Diode Switching Loss

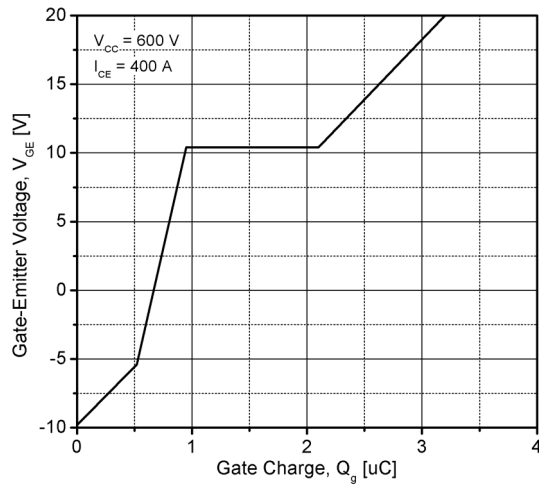


Fig 20. Typical Gate Charge Characteristics

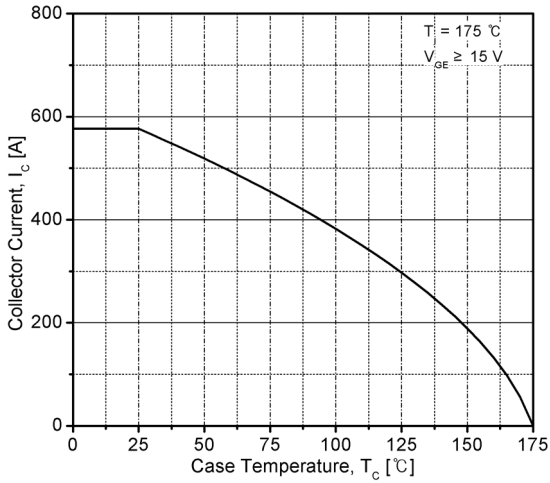


Fig 21. Case Temp vs. Collector Current

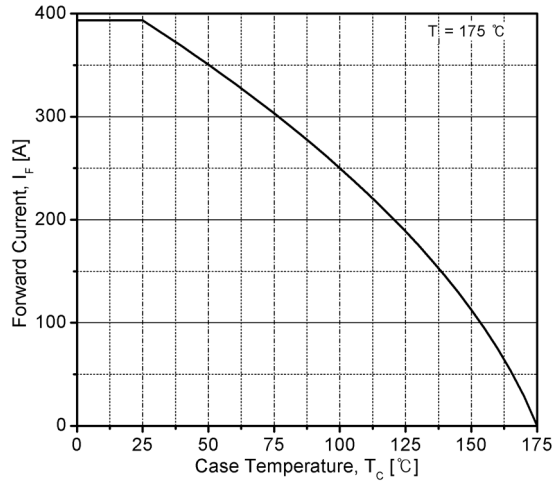


Fig 22. Case Temp vs. Inverse Diode Current

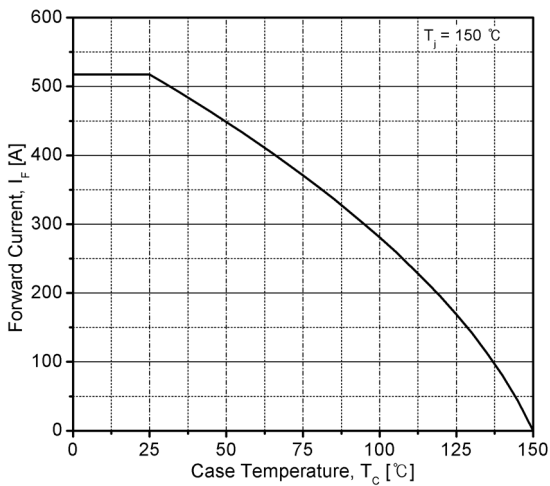


Fig 23. Case Temp vs. Free-wheeling Diode Current

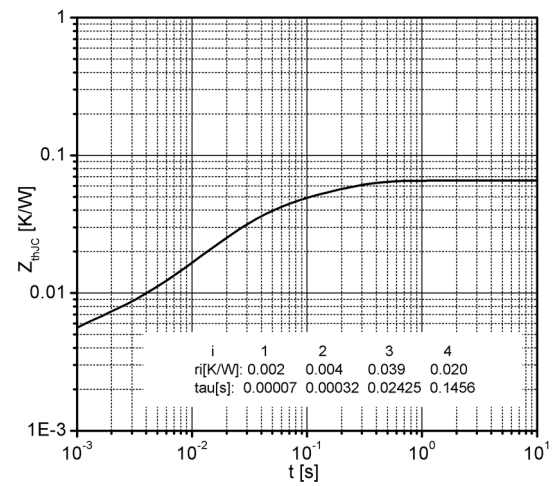


Fig 24. Typical IGBT Thermal Impedance

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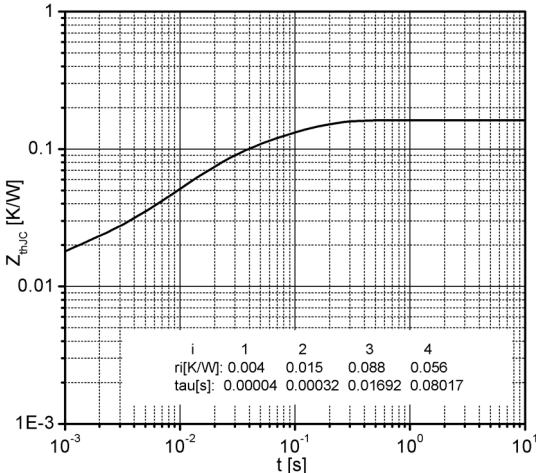


Fig 25. Typical Inverse Diode Thermal Impedance

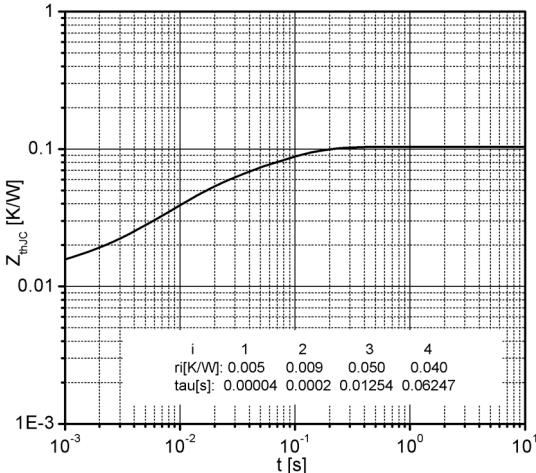
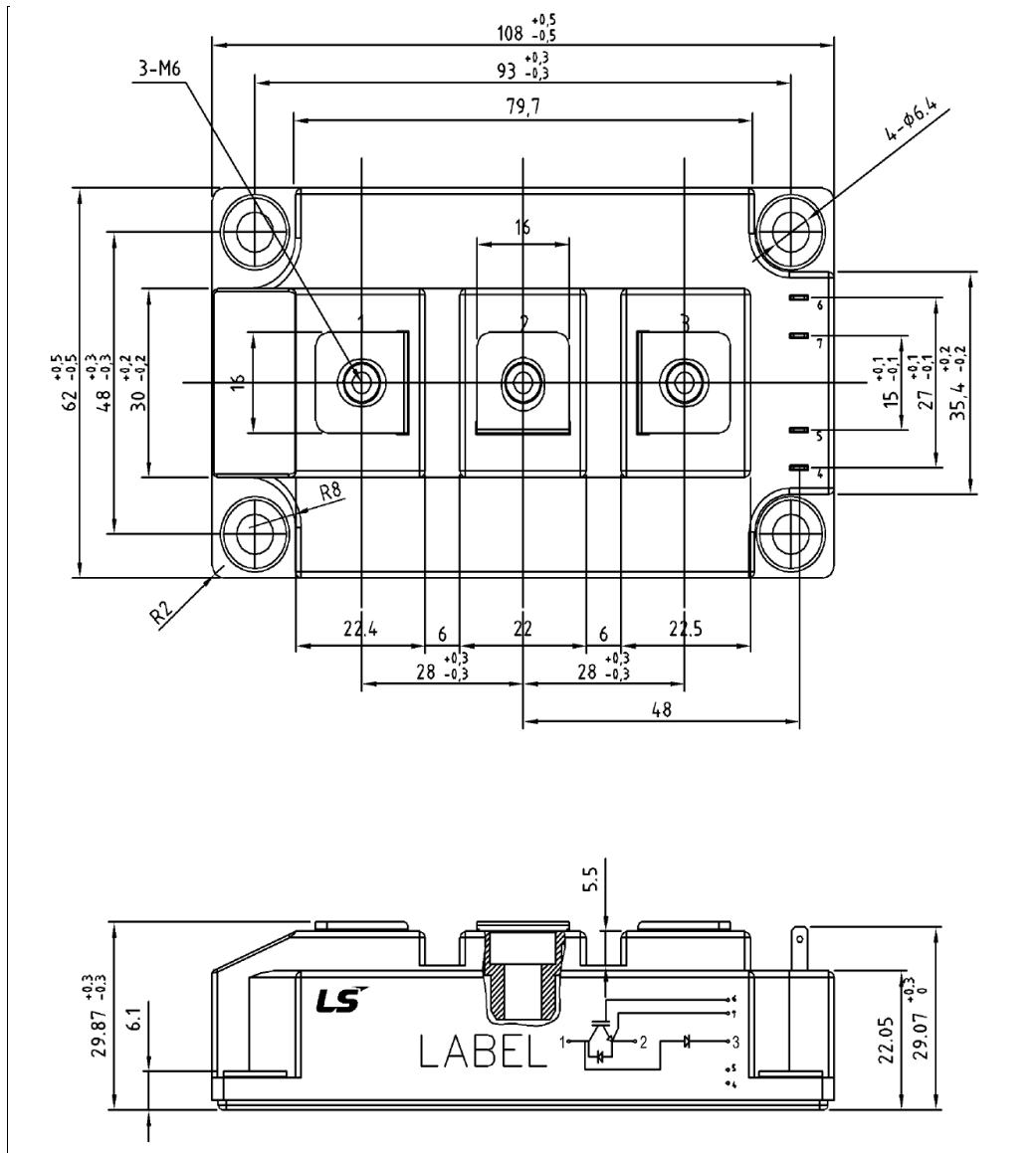


Fig 26. Free-Wheeling Diode Thermal Impedance

## Package Dimension (Dimension in mm)



## Circuit Description

