V_{CE} = 650 V, I_C = 50 A
Trench Field Stop IGBT

KGF65B5H

Data Sheet

Description

The KGF65B5H is 650 V field Stop IGBT with a fast recovery diode. Sanken original trench structure decreases gate capacitance, and achieves high speed switching and switching loss reduction. Thus, the field stop IGBT can improve the efficiency of your circuit.

Features

- V_{CE} ---------- 650 V
- I_C (T_C = 100 °C) ----------50 A
- $V_{CE(SAT)}$ ---------- 1.4 V typ.
- V_F ---------- 1.3 V typ.

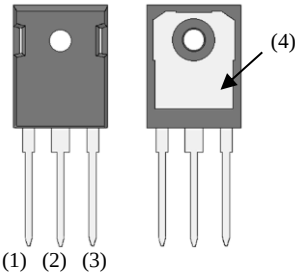
- Pb-free (RoHS Compliant)
- Low Saturation Voltage
- High Speed Switching
- With Fast Recovery Diode

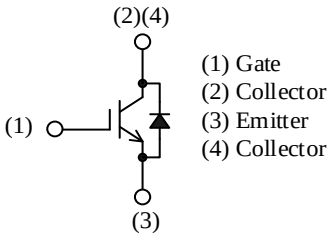
Applications

- Solar Power Conditioners, UPS Inverter Circuit
- General-purpose Converter Circuit
- Welding Machine

Package

TO247-3L





Not to scale

Absolute Maximum Ratings

Unless specifically noted, T_A = 25 °C.

Parameter	Symbol	Conditions	Rating	Unit
Collector-to-Emitter Voltage	V_{CE}		650	V
Gate-to-Emitter Voltage	V_{GE}		±20	V
Continuous Collector Current	I_C	T_C = 25 °C	80(1)	A
		T_C = 100 °C	50	A
Pulsed Collector Current	$I_{C(PULSE)}$	Pulse width ≤ 1 ms, duty cycle ≤ 1%	150	A
Diode Continuous Forward Current	I_F	T_C = 25 °C	80(1)	A
		T_C = 100 °C	50	A
Diode Pulsed Forward Current	$I_{F(PULSE)}$	Pulse width ≤ 1 ms, duty cycle ≤ 1%	150	A
Power Dissipation	P_D	T_C = 25 °C	240	W
Junction Temperature	T_J		175	°C
Storage Temperature	T_{STG}		−55 to 150	°C

Thermal Resistance Characteristics

Unless specifically noted, T_A = 25 °C.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Thermal Resistance of IGBT (Junction to Case)	$R_{\theta JC(IGBT)}$		—	—	0.62	°C/W
Thermal Resistance of Diode (Junction to Case)	$R_{\theta JC(DI)}$		—	—	0.87	°C/W

Mechanical Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Unit
Package Weight		—	6.1	—	g
Heatsink Mounting Screw Torque		0.686	—	0.882	N·m

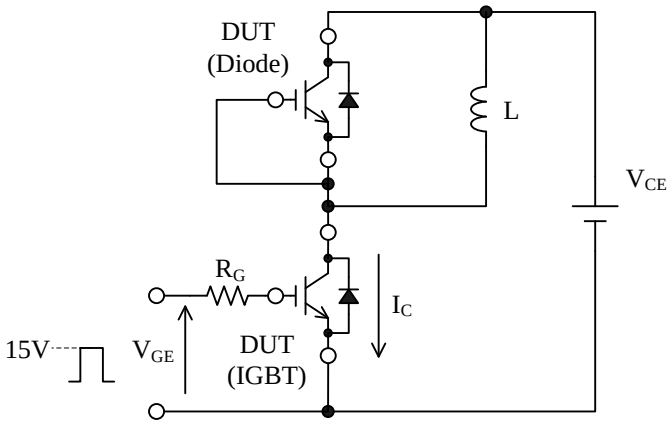
(1) Limited by bonding wire.

Electrical Characteristics

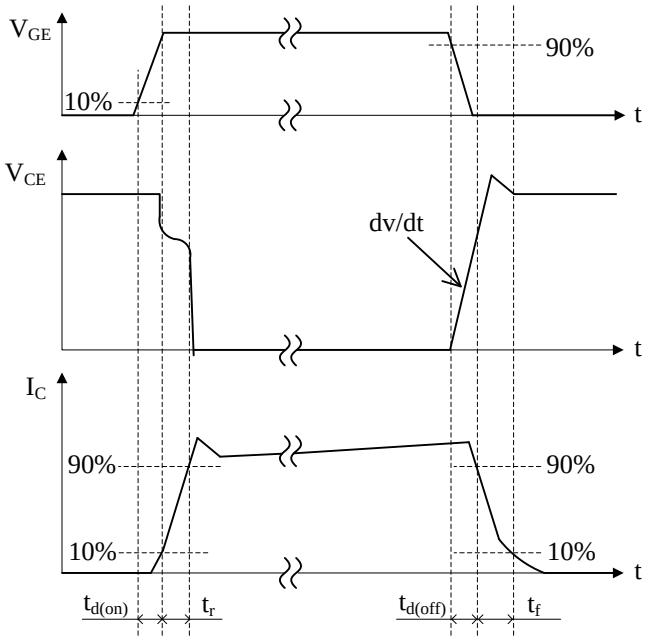
Unless otherwise specified, T_A = 25 °C.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Collector-to-Emitter Breakdown Voltage	$V_{(BR)CES}$	I_C = 100 µA, V_{GE} = 0 V	650	—	—	V
Collector-to-Emitter Leakage Current	I_{CES}	V_{CE} = 650 V, V_{GE} = 0 V	—	—	100	µA
Gate-to-Emitter Leakage Current	I_{GES}	V_{GE} = ±20 V	—	—	±500	nA
Gate Threshold Voltage	$V_{GE(TH)}$	V_{CE} = 10 V, I_C = 1 mA	4.0	5.5	7.0	V
Collector-to-Emitter Saturation Voltage	$V_{CE(SAT)}$	V_{GE} = 15 V, I_C = 50 A	—	1.4	1.9	V
Input Capacitance	C_{ies}	V_{CE} = 20 V, V_{GE} = 0 V, f = 100 kHz	—	7500	—	pF
Output Capacitance	C_{oes}		—	400	—	pF
Reverse Transfer Capacitance	C_{res}		—	300	—	pF
Total Gate Charge	Q_G	V_{CE} = 520 V, I_C = 50 A, V_{GE} = 15 V	—	310	—	nC
Turn-on Delay Time	$t_{d(ON)}$	T_C = 25 °C, V_{CE} = 400 V, I_C = 50 A, V_{GE} = 15 V, R_G = 5 Ω, L = 100 µH; see Figure 1	—	40	—	ns
Turn-on Rise Time	t_r		—	50	—	ns
Turn-off Delay Time	$t_{d(OFF)}$		—	240	—	ns
Turn-off Fall Time	t_f		—	50	—	ns
Turn-on Switching Losses [2]	E_{ON}		—	1.9	—	mJ
Turn-off Switching Losses	E_{OFF}		—	1.0	—	mJ
Turn-on Delay Time	$t_{d(ON)}$	T_C = 175 °C, V_{CE} = 400 V, I_C = 50 A, V_{GE} = 15 V, R_G = 5 Ω, L = 100 µH, see Figure 1	—	40	—	ns
Turn-on Rise Time	t_r		—	50	—	ns
Turn-off Delay Time	$t_{d(OFF)}$		—	250	—	ns
Turn-off Fall Time	t_f		—	120	—	ns
Turn-on Switching Losses [2]	E_{ON}		—	2.6	—	mJ
Turn-off Switching Losses	E_{OFF}		—	1.3	—	mJ
Diode Forward Voltage Drop	V_F	I_F = 50 A	—	1.3	1.65	V
Diode Reverse Recovery Time	t_{rr}	I_F = 50 A, di/dt = 700 A/µs	—	120	—	ns

[2] Energy losses include the reverse recovery of diode.



(a) Test Circuit



(b) Waveform

Figure 1. Switching Time

Derating Curves

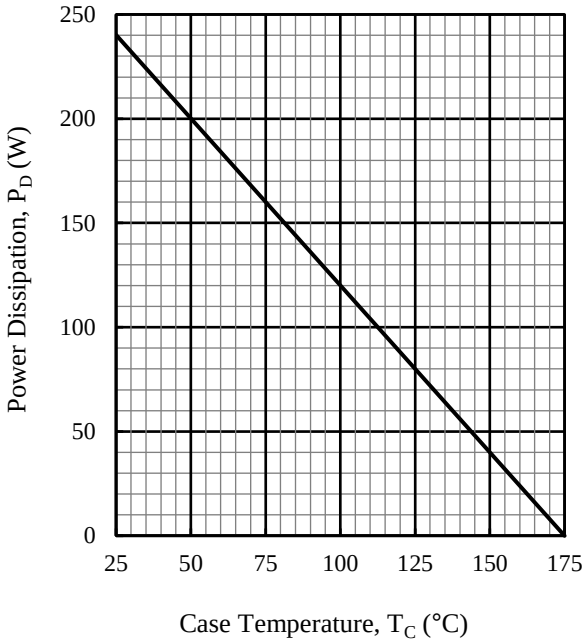


Figure 2. P_D vs. T_C
(T_J < 175 °C)

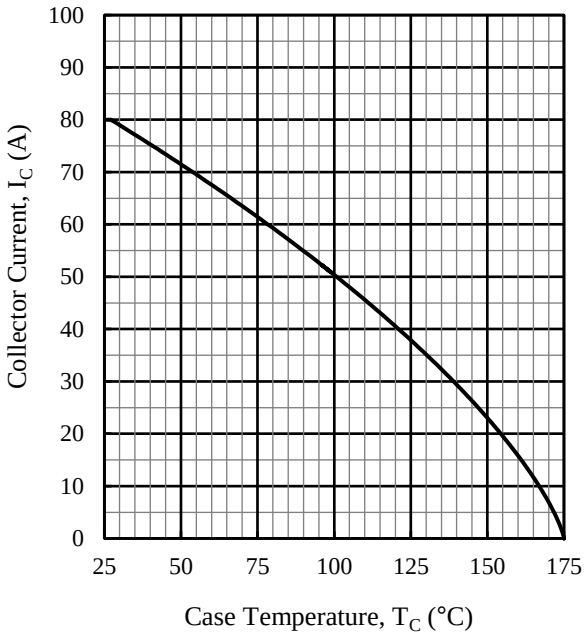


Figure 3. I_C vs. T_C
(T_J < 175 °C)

Typical Characteristic Curves

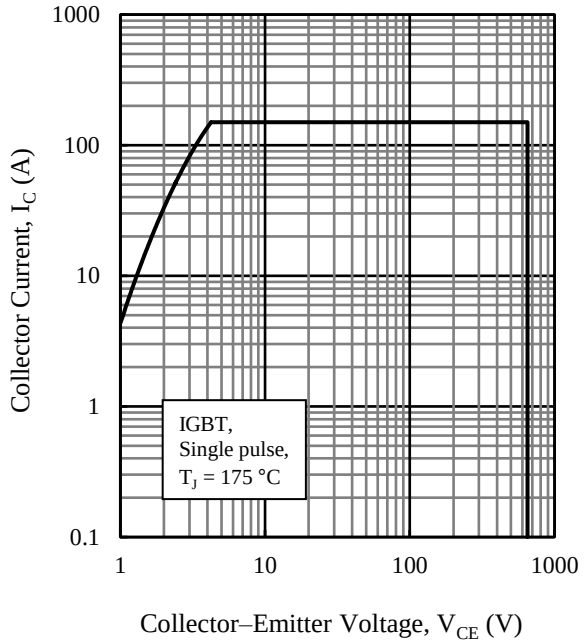


Figure 4. Reverse Bias Safe Operating Area

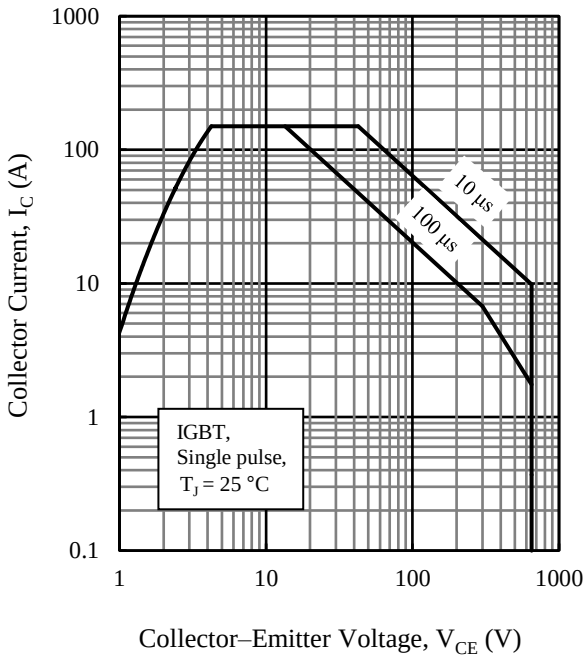


Figure 5. Safe Operating Area

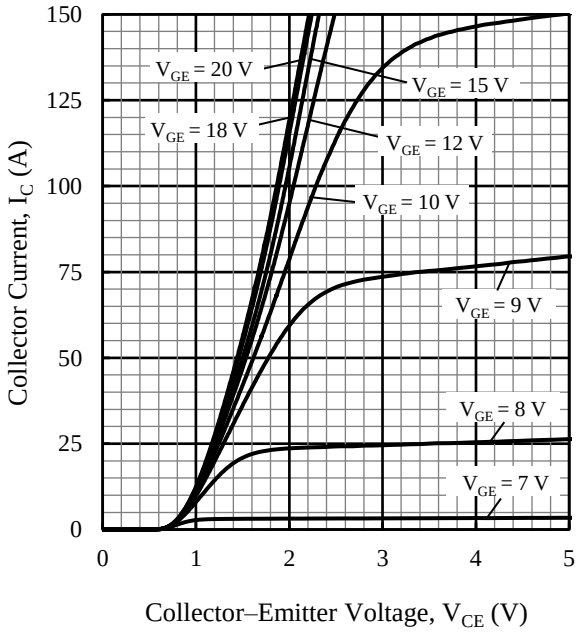


Figure 6. Typical Characteristics: I_C vs. V_{CE} (T_J = 25 °C)

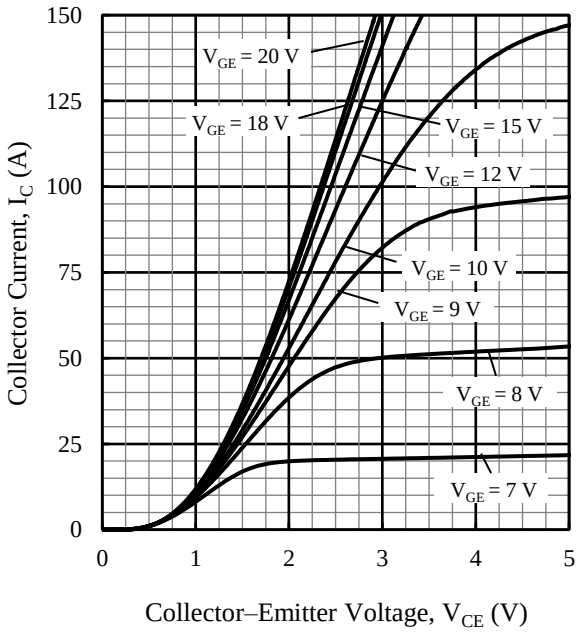


Figure 7. Typical Characteristics: I_C vs. V_{CE} (T_J = 175 °C)

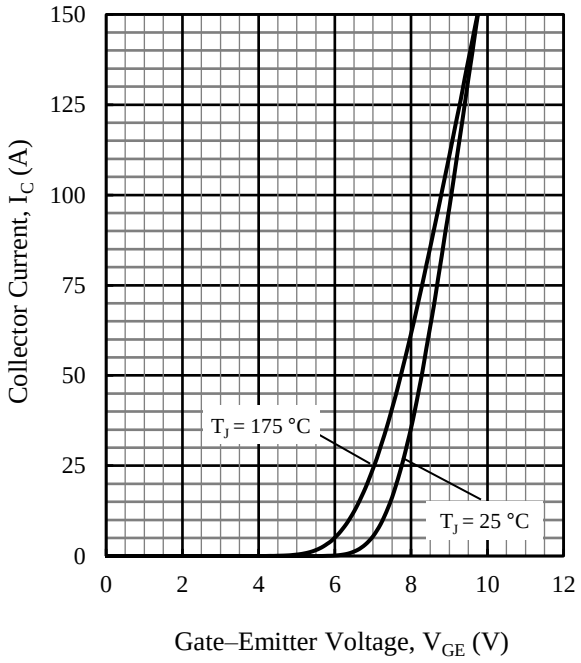


Figure 8. Typical Characteristics: I_C vs. V_{CE} (V_{CE} = 20 V)

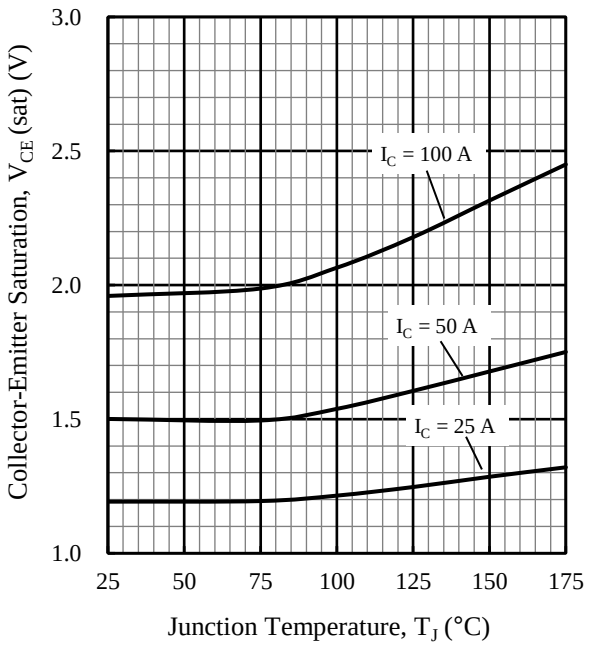


Figure 9. Typical Characteristics: $V_{CE(SAT)}$ vs. T_J (V_{GE} = 15 V)

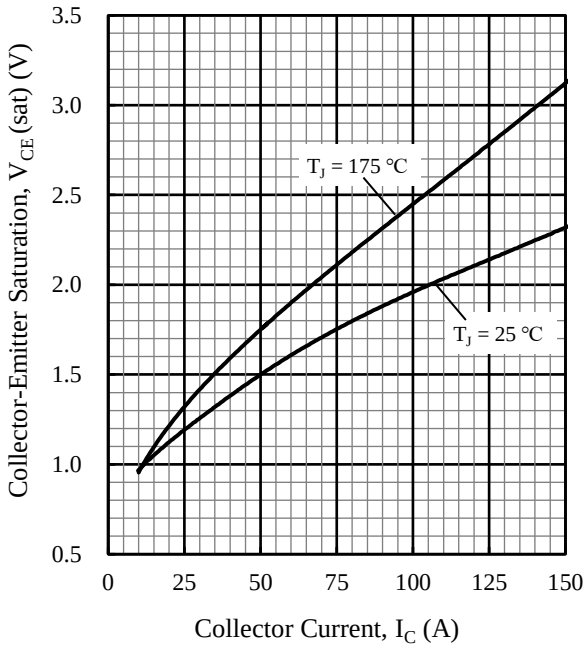


Figure 10. Typical Characteristics: $V_{CE(SAT)}$ vs. I_C (V_{GE} = 15 V)

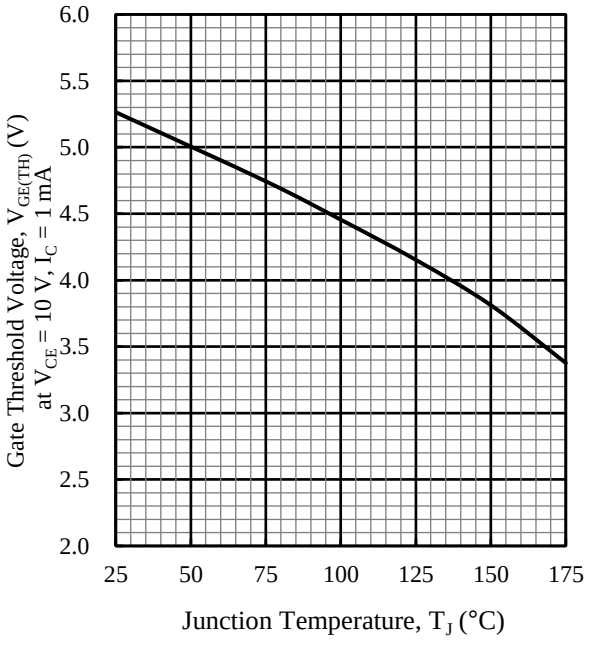


Figure 11. Typical Characteristics: $V_{GE(TH)}$ vs. T_J (V_{CE} = 10 V, I_C = 1 mA)

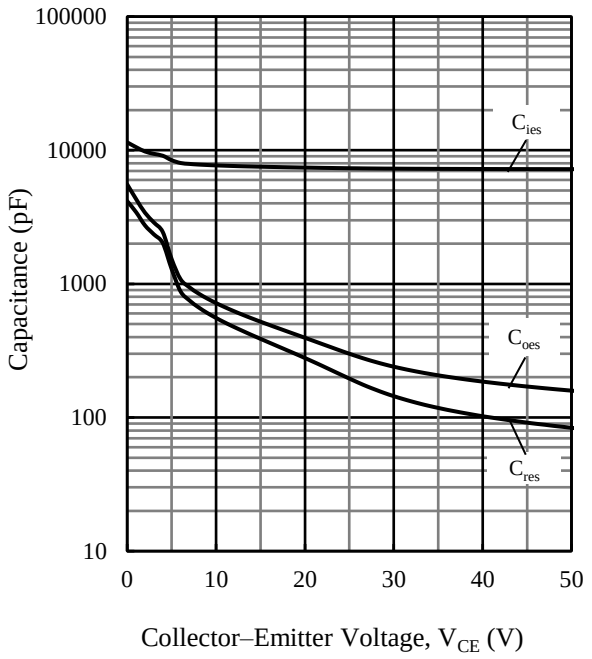


Figure 12. Typical Characteristics:
Capacitance vs. V_{CE} (f = 100 kHz, V_{GE} = 0 V)

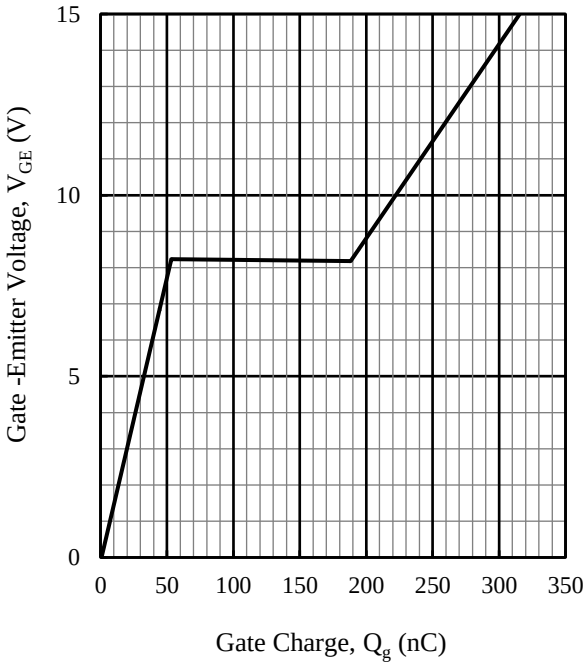


Figure 13. Typical Characteristics:
V_{GE} vs. Q_G (I_C = 50 A, V_{CE} ≈ 520 V)

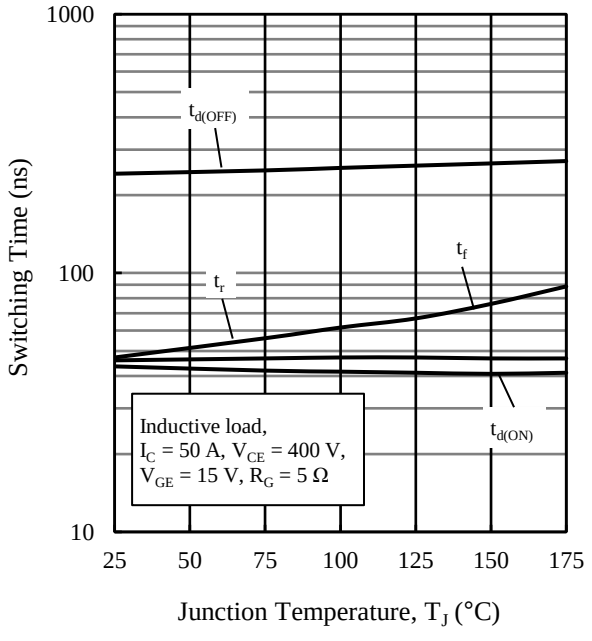


Figure. 14. Typical Characteristics:
Switching Time vs. T_J

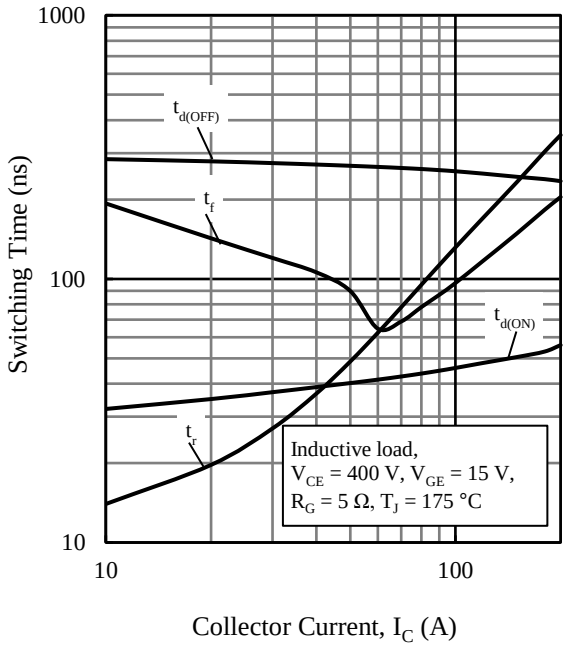


Figure 15. Typical Characteristics:
Switching Time vs. I_C

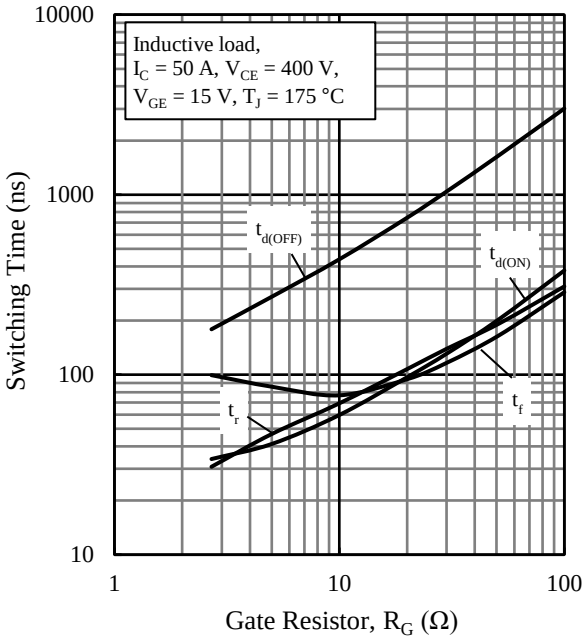


Figure 16. Typical Characteristics: Switching Time vs. R_G

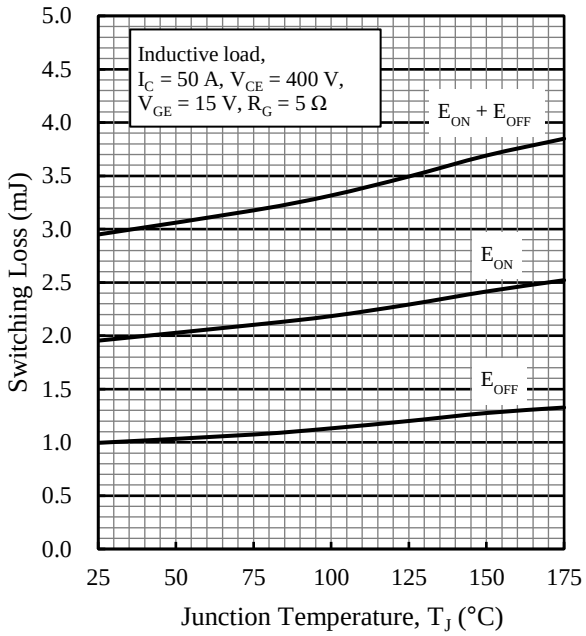


Figure 17. Typical Characteristics: Switching Loss vs. T_J

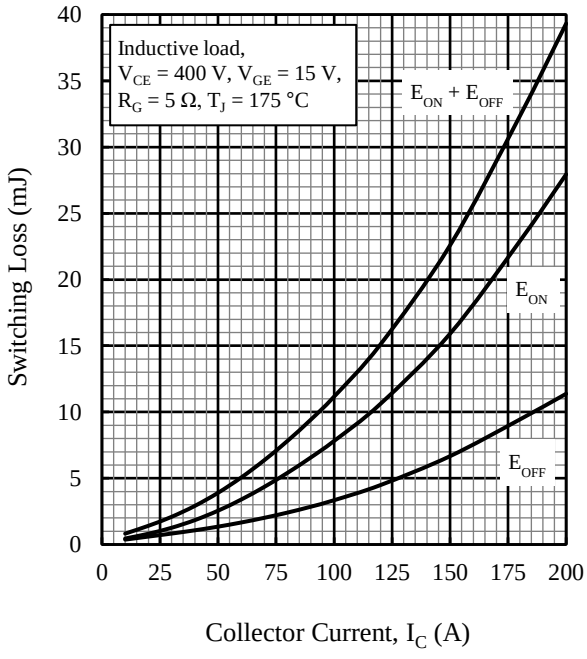


Figure 18. Typical Characteristics: Switching Loss vs. I_C

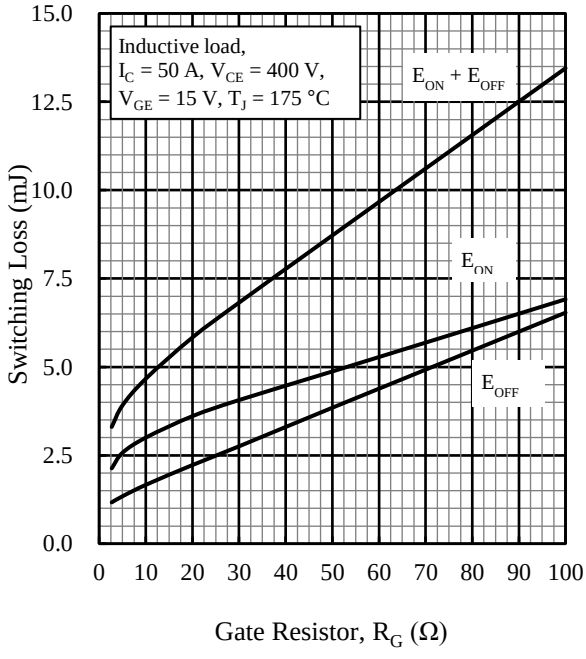


Figure 19. Typical Characteristics: Switching Loss vs. R_G

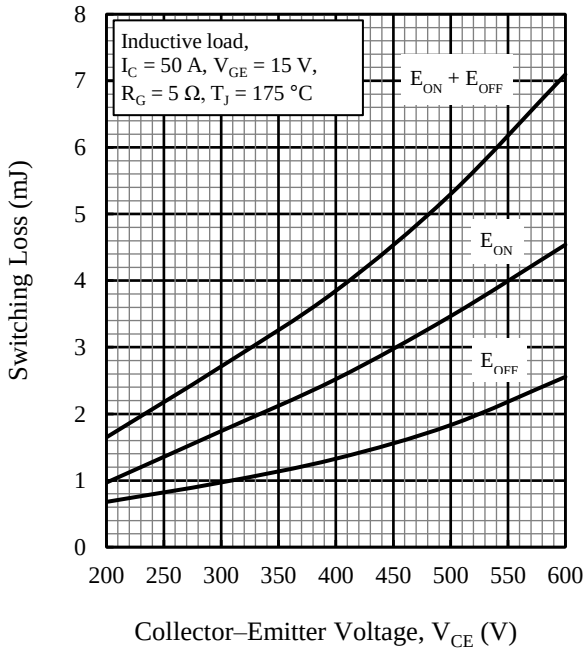


Figure 20. Typical Characteristics: Switching Loss vs. V_{CE}

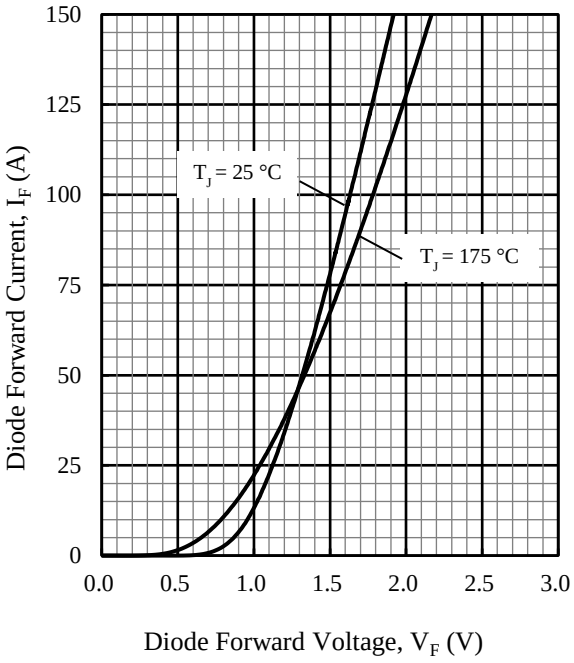


Figure 21. Typical Characteristics: I_F vs. V_F

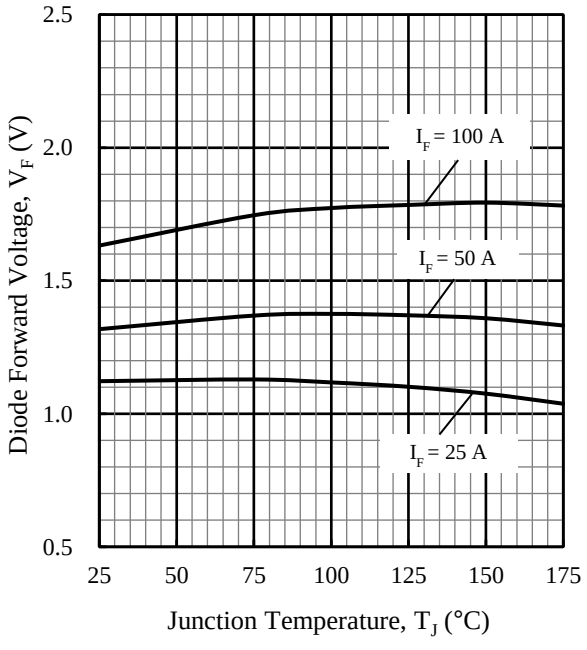


Figure 22. Typical Characteristics: V_F vs. T_J

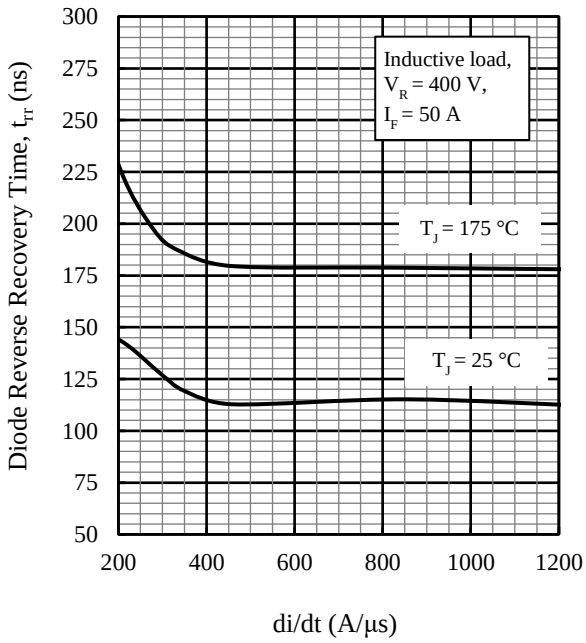


Figure 23. Typical Characteristics: t_{rr} vs. di/dt

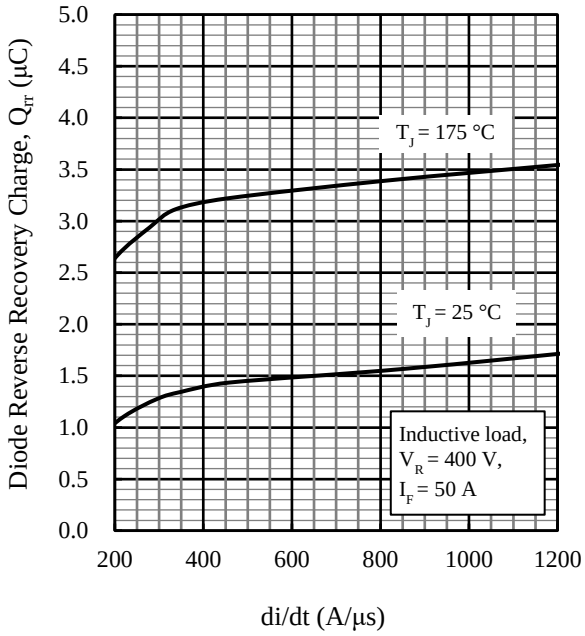


Figure 24. Typical Characteristics: Q_{rr} vs. di/dt

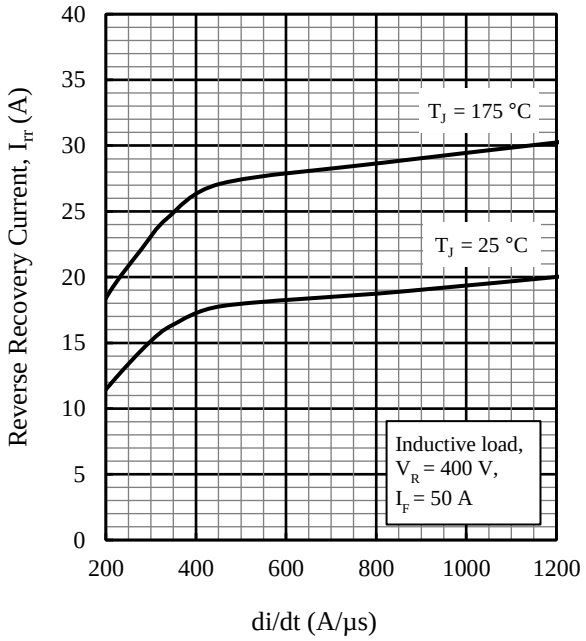


Figure 25. Typical Characteristics: I_{rr} vs. di/dt

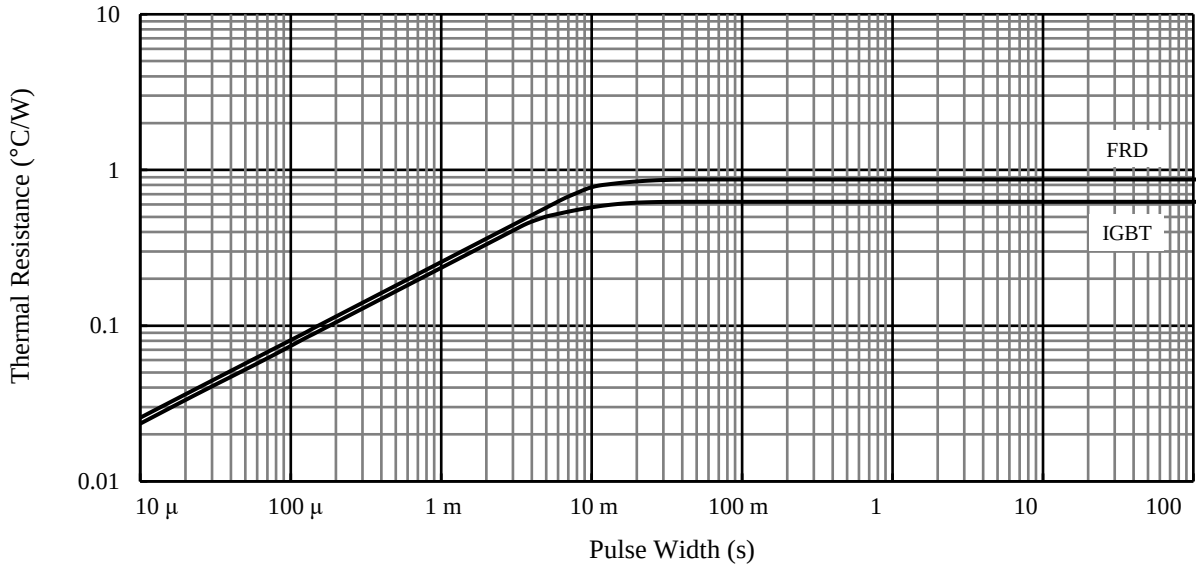
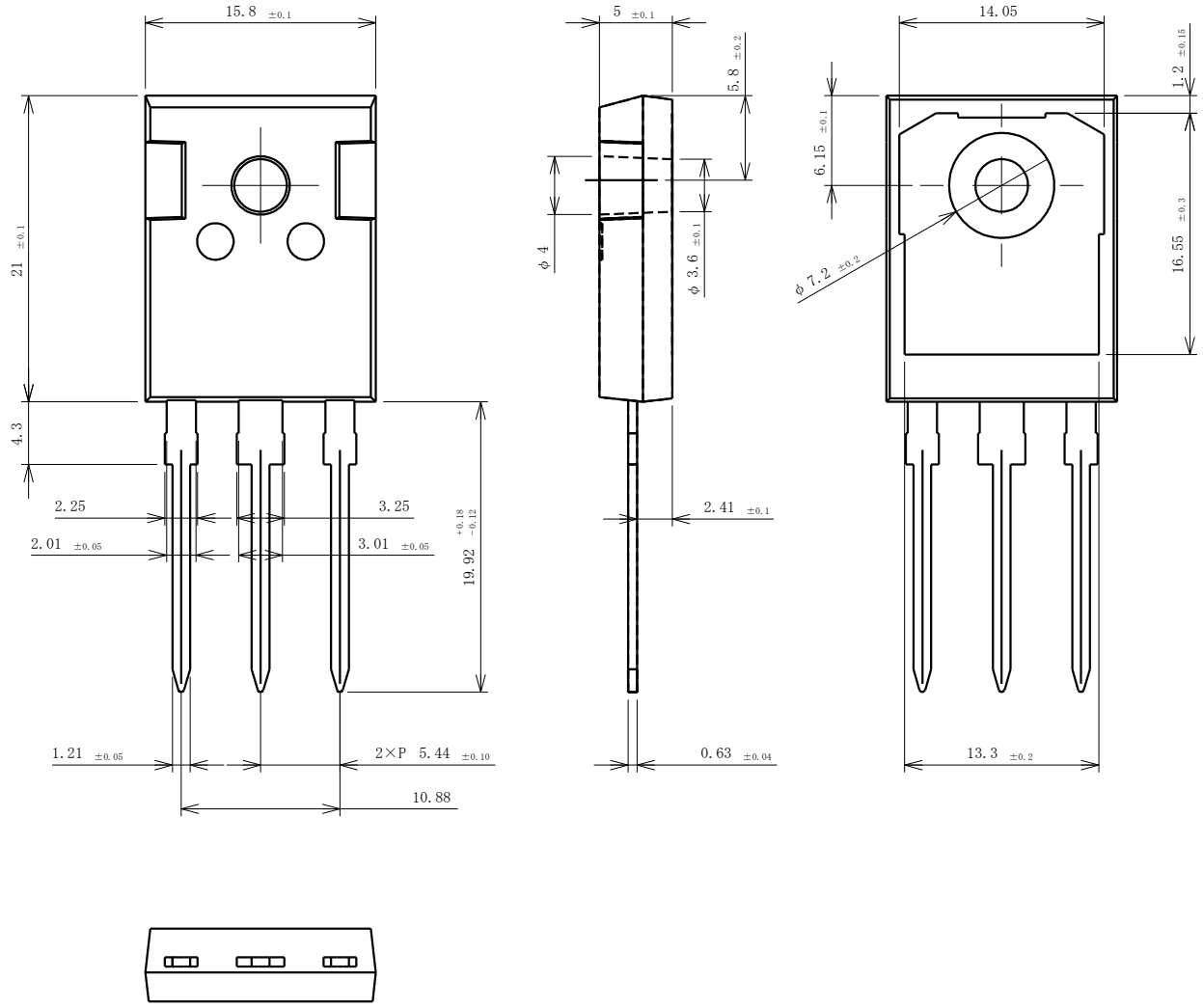


Figure 26. Transient Thermal Resistance Characteristics (Single Pulse, V_{CE} < 10 V)

Physical Dimensions

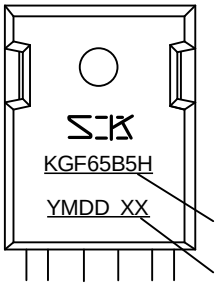
● **TO247-3L**



NOTES:

- Dimensions in millimeters
- Excludes mold flash
- Dimensions in millimeters
- Bare lead: Pb-free (RoHS compliant)
- When soldering the products, it is required to minimize the working time within the following limits:
  Flow: 270 °C / 7 s, 1 time
  Soldering Iron: 350 °C / 3.5 s, 1 time (Soldering should be at a distance of at least 1.5 mm from the body of the product.)

Marking Diagram



Part Number

Lot Number

Y is the last digit of the year of manufacture (0 to 9)
M is the month of the year (1 to 9, O, N, or D)
DD is the day of the month (01 to 31)
XX is the control number

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