V_{CE} = 650 V, I_C = 15 A
Trench Field Stop IGBT

FGA65A3H

Data Sheet

Description

FGA65A3H is 650 V Field Stop IGBT. Sanken original trench structure decreases gate capacitance, and achieves high speed switching and switching loss reduction. Thus, Field Stop IGBT can improve the efficiency of your circuit.

Features

- Low Saturation Voltage
- High Speed Switching
- Bare Lead Frame: Pb-free (RoHS Compliant)

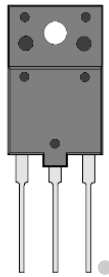
- V_{CE} ---------- 650 V
- I_C (T_C = 100 °C) ---------- 15 A
- Short Circuit Withstand Time ---------- 10 µs
- $V_{CE(sat)}$ ---------- 1.9 V typ.
- t_f (T_J = 175 °C) ---------- 60 ns typ.

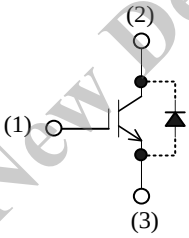
Applications

- DCM and CRM PFC Circuit

Packages

TO3PF-3L





(1) Gate
(2) Collector
(3) Emitter

Not to scale

Absolute Maximum Ratings

Unless otherwise specified, T_A = 25 °C.

Parameter	Symbol	Conditions	Rating	Unit	Remarks
Collector to Emitter Voltage	V_{CE}		650	V	
Gate to Emitter Voltage	V_{GE}		±30	V	
Continuous Collector Current	I_C	T_C = 25 °C	25	A	
		T_C = 100 °C	15	A	
Pulsed Collector Current	$I_{C(PULSE)}$	$P_W \leq 1$ ms, duty cycle ≤ 1%	90	A	
Diode Continuous Forward Current	I_F	T_C = 25 °C	0.5	A	
		T_C = 100 °C	0.2	A	
Diode Pulsed Forward Current	$I_{F(PULSE)}$	$P_W \leq 1$ ms, duty cycle ≤ 1%	2	A	
Short Circuit Withstand Time	t_{SC}	V_{GE} = 15 V, V_{CE} = 400 V, T_J = 175 °C	10	μs	
Power Dissipation	P_D	T_C = 25 °C	72	W	
Operating Junction Temperature	T_J		175	°C	
Storage Temperature	T_{STG}		−55 to 150	°C	
Isolation Voltage	$V_{ISO(RMS)}$	Between surface of case and each pin; AC, 60 Hz, 1 min	1500	V	

Thermal Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	Remarks
Thermal Resistance (Junction to Case)	$R_{\theta JC}$		—	—	2.08	°C/W	

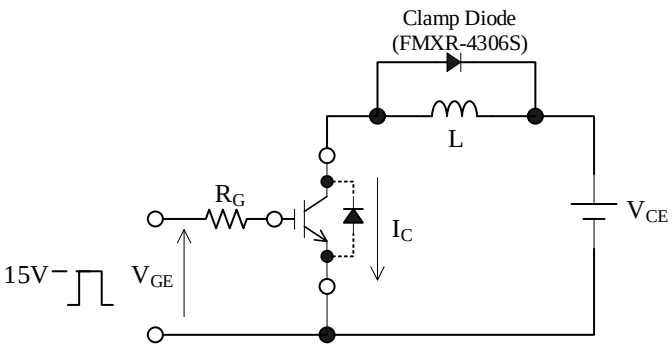
Electrical Characteristics

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} = ±30 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 = 30 A	—	1.9	2.37	V
Input Capacitance	C_{ies}	V_{CE} = 20 V, V_{GE} = 0 V, f = 1.0 MHz	—	1800	—	pF
Output Capacitance	C_{oes}		—	200	—	
Reverse Transfer Capacitance	C_{res}		—	80	—	
Gate Charge	Q_g	V_{CE} = 520 V, I_C = 30 A, V_{GE} = 15 V	—	60	—	nC
Turn-on Delay Time	$t_{d(on)}$	T_J = 25 °C; see Figure 1	—	30	—	ns
Rise Time	t_r		—	30	—	
Turn-off Delay Time	$t_{d(off)}$		—	90	—	
Fall Time	t_f		—	30	—	
Turn-on Energy (1)	E_{on}		—	0.5	—	mJ
Turn-off Energy	E_{off}		—	0.4	—	
Turn-on Delay Time	$t_{d(on)}$	T_J = 175 °C; see Figure 1	—	30	—	ns
Rise Time	t_r		—	30	—	
Turn-off Delay Time	$t_{d(off)}$		—	120	—	
Fall Time	t_f		—	60	—	
Turn-on Energy (1)	E_{on}		—	0.8	—	mJ
Turn-off Energy	E_{off}		—	0.7	—	
Emitter to Collector Diode Forward Voltage	V_F	I_F = 0.5 A	—	2.0	—	V

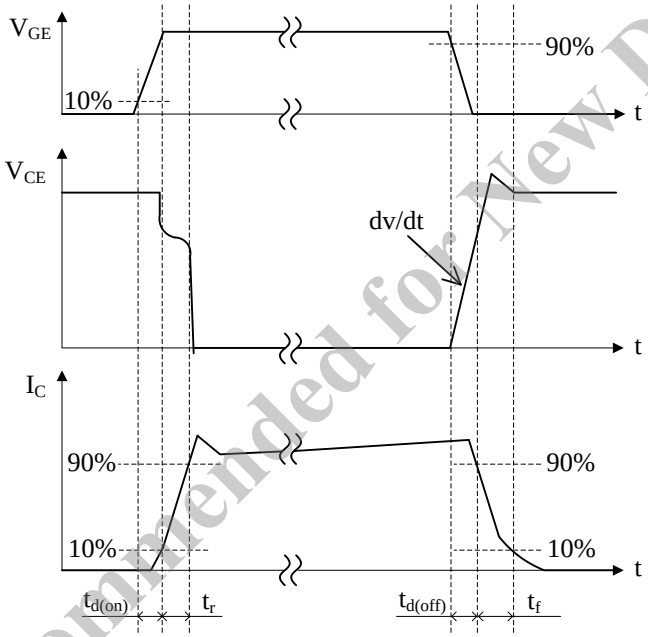
(1) Energy losses include the reverse recovery of diode.

Test Circuits and Waveforms



Conditions:
V_{CE} = 400 V
I_C = 30 A
V_{GE} = 15 V
R_G = 10 Ω
L = 100 μH

(a) Test Circuit



(b) Waveform

Figure 1. Test Circuits and Waveforms of dv/dt and Switching Time

Rating and Characteristic Curves

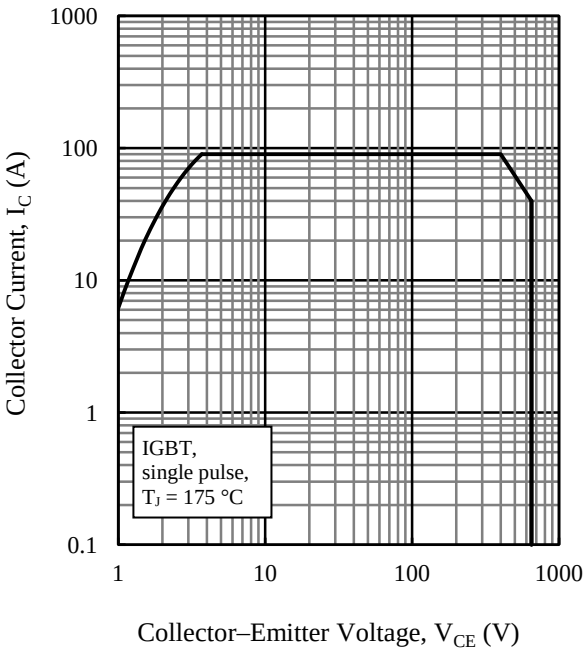


Figure 2. IGBT Reverse Bias Safe Operating Area

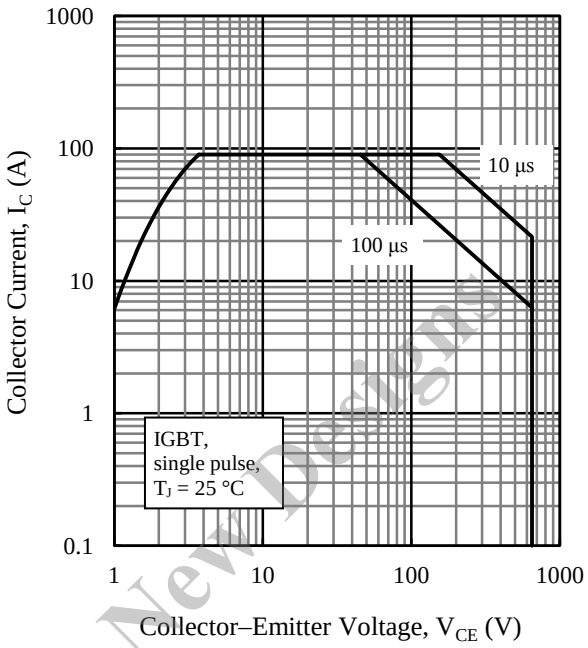


Figure 3. IGBT Safe Operating Area

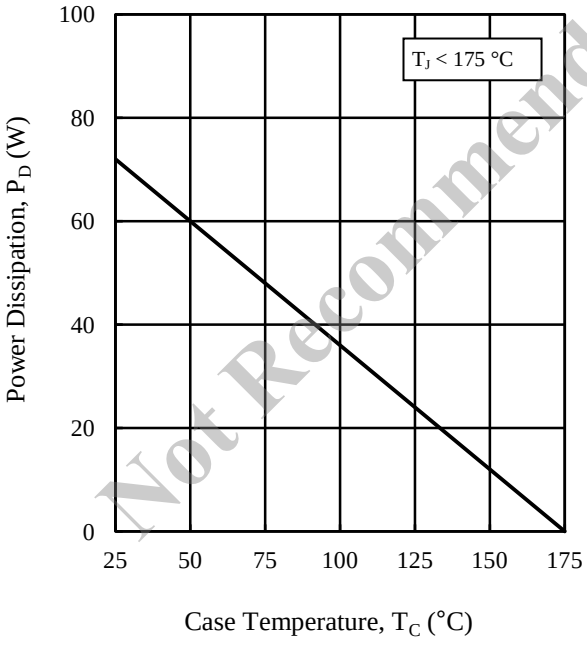


Figure 4. Power Dissipation vs. Case Temperature

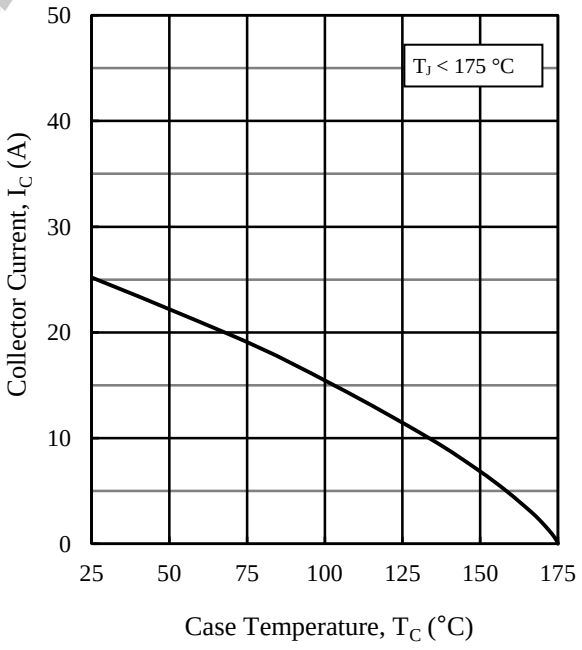


Figure 5. Collector Current vs. Case Temperature

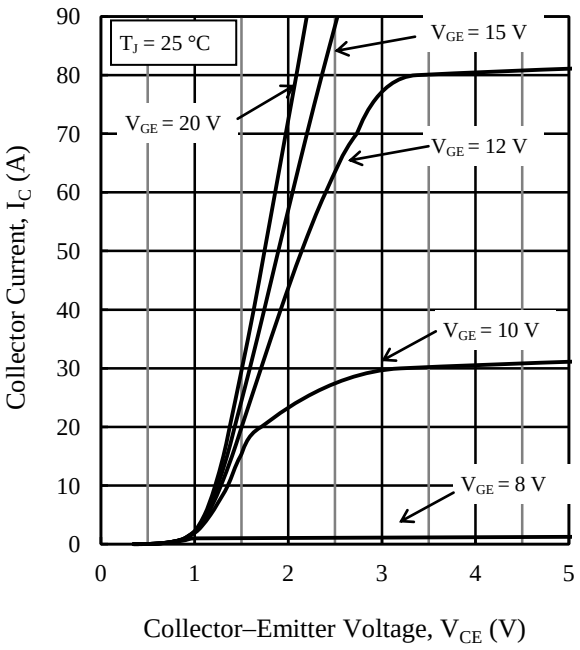


Figure 6. Output Characteristics (T_J = 25 °C)

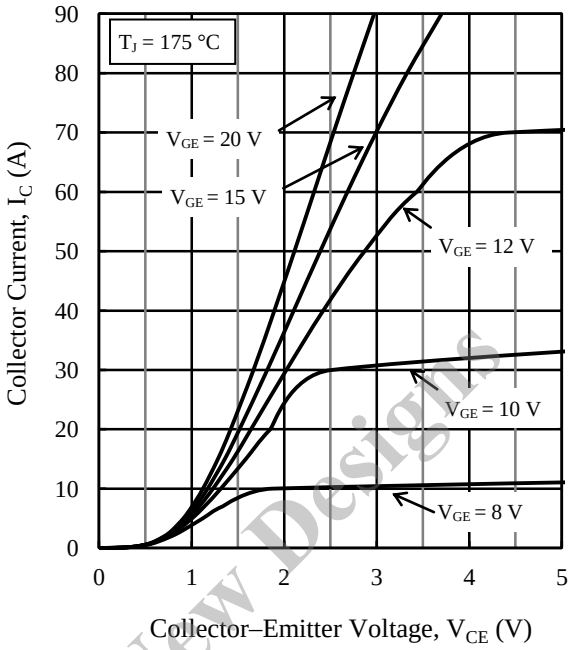


Figure 7. Output Characteristics (T_J = 175 °C)

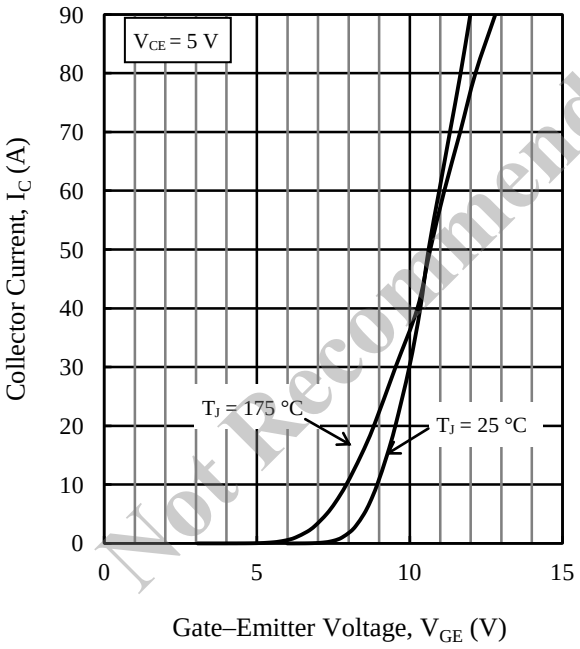


Figure 8. Transfer Characteristics

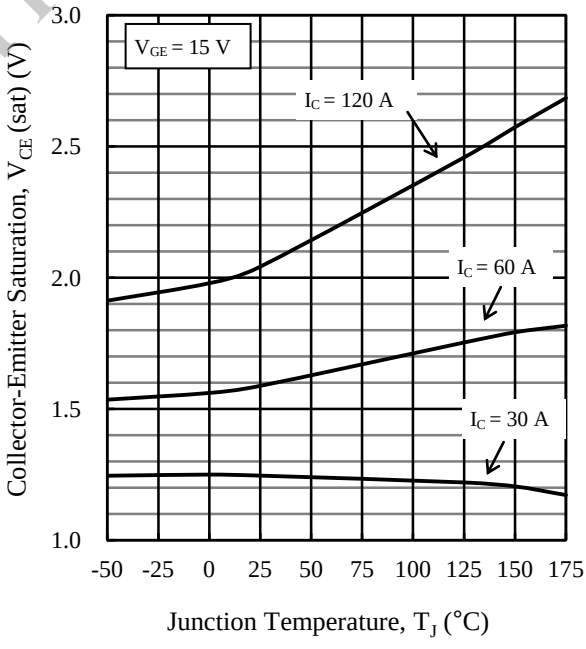


Figure 9. Saturation Voltage vs. Junction Temperature

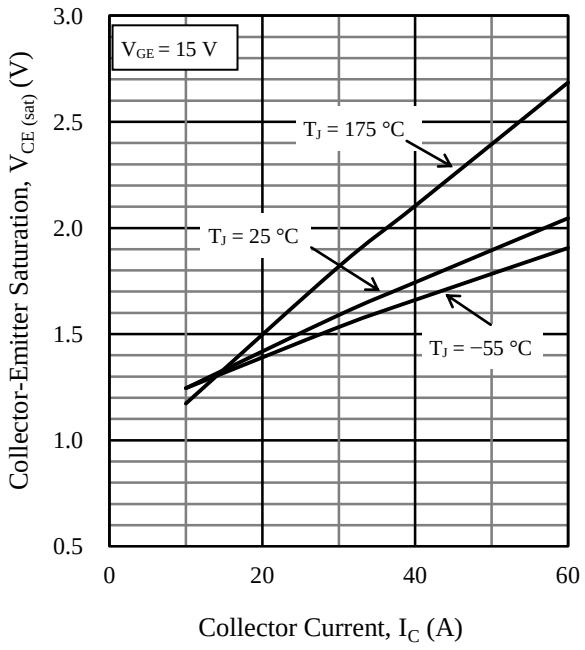


Figure 10. Saturation Voltage vs. Collector Current

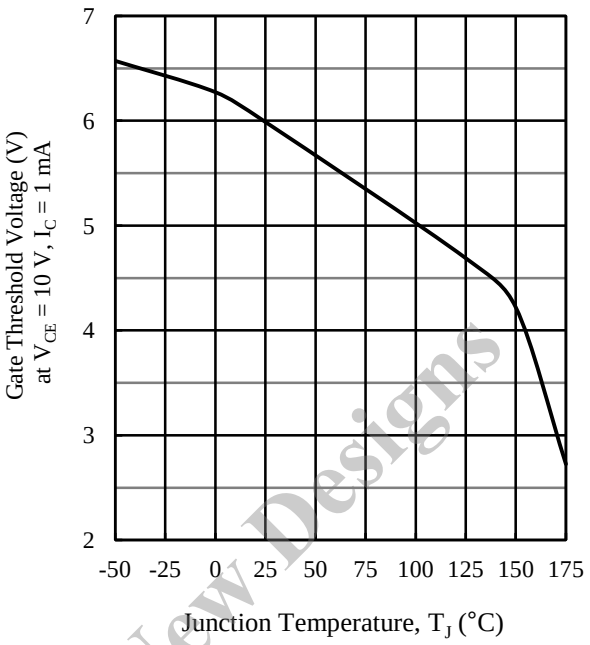


Figure 11. Gate Threshold Voltage vs. Junction Temperature

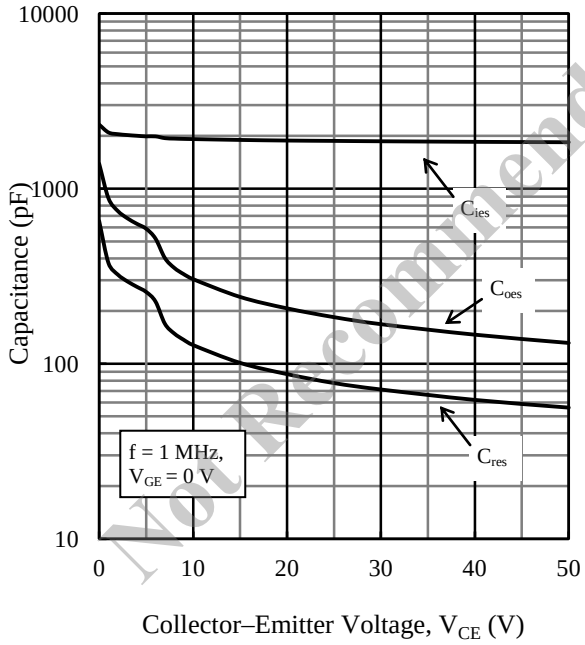


Figure 12. Capacitance Characteristics

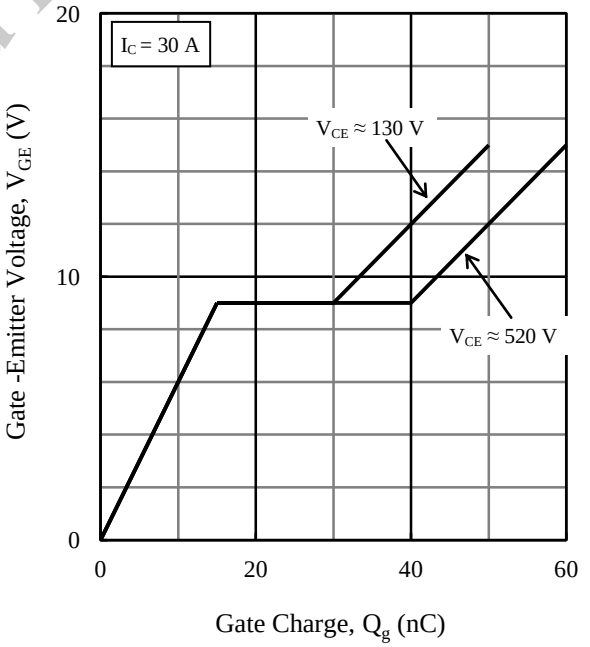


Figure 13. Typical Gate Charge

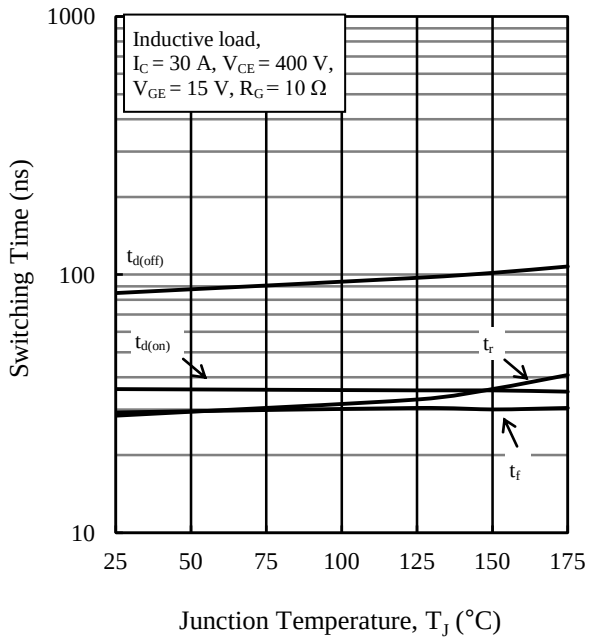


Figure 14. Switching Time vs. Junction Temperature

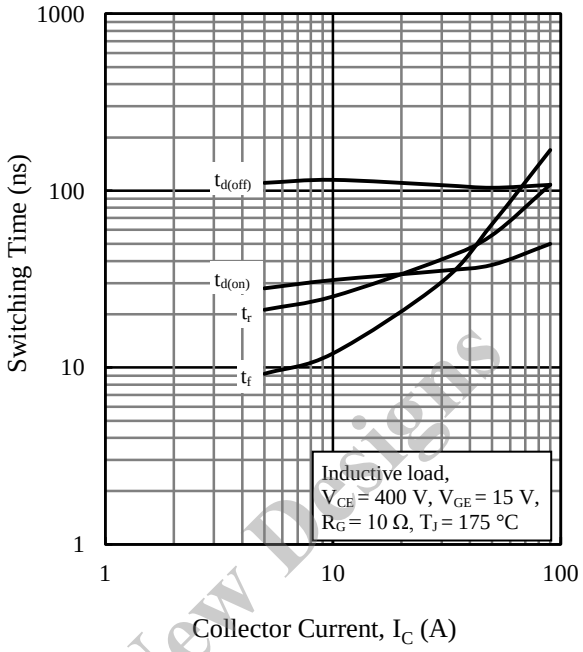


Figure 15. Switching Time vs. Collector Current

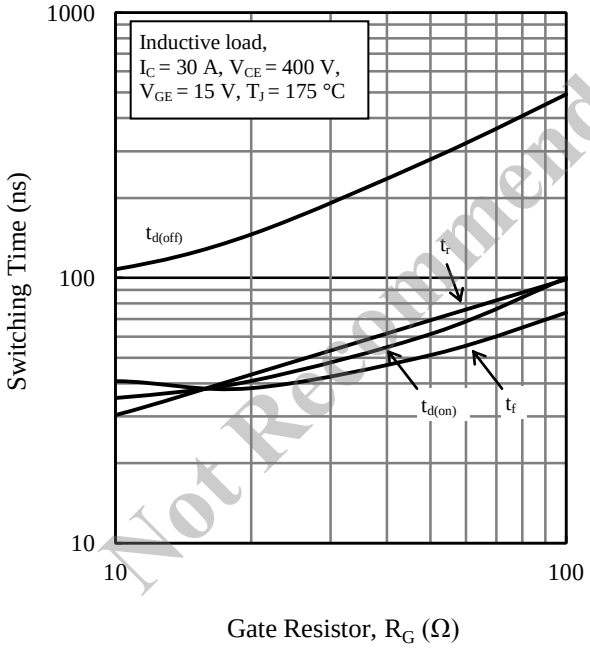


Figure 16. Switching Time vs. Gate Resistor

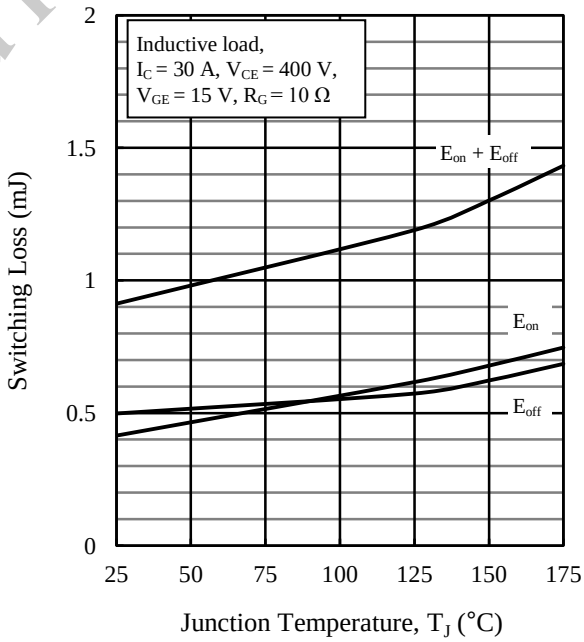


Figure 17. Switching Loss vs. Junction Temperature

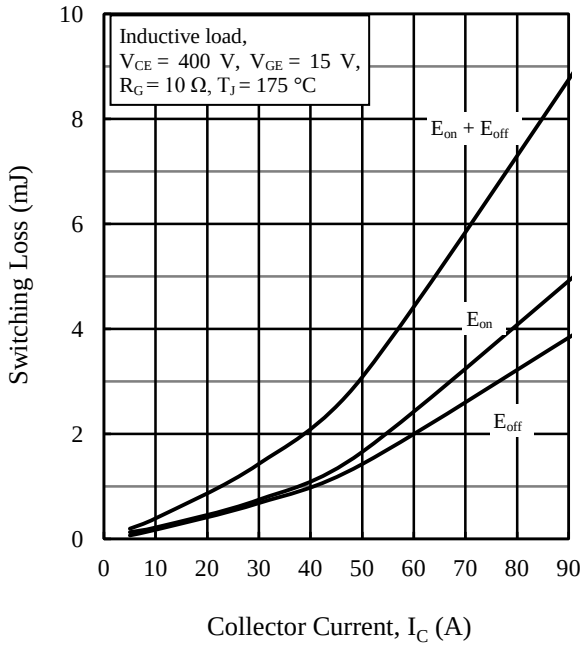


Figure 18. Switching Loss vs. Collector Current

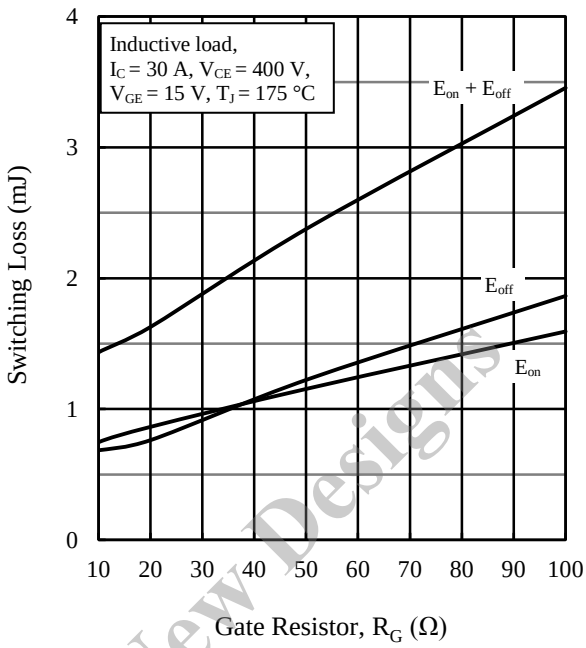


Figure 19. Switching Loss vs. Gate Resistor

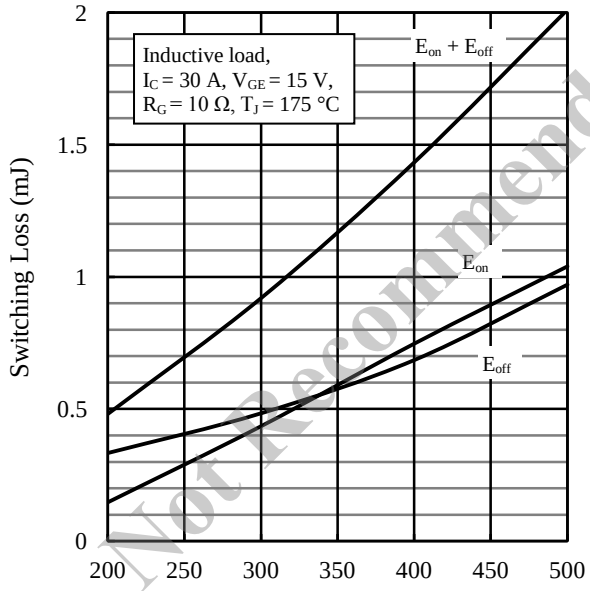


Figure 20. Switching Loss vs. Collector–Emitter Voltage

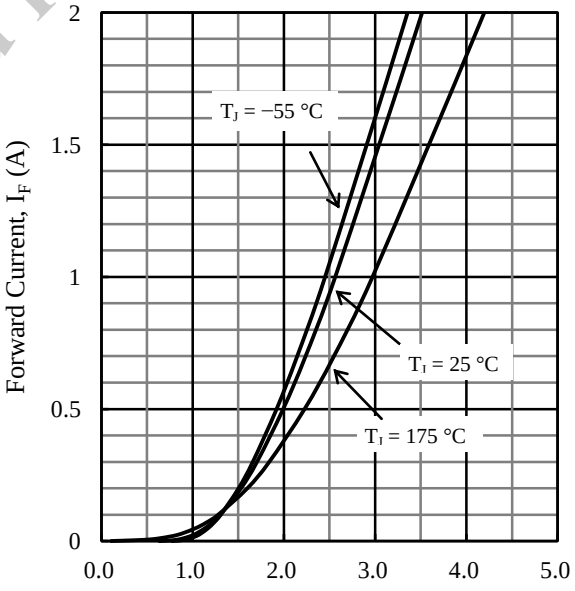


Figure 21. Diode Forward Characteristics

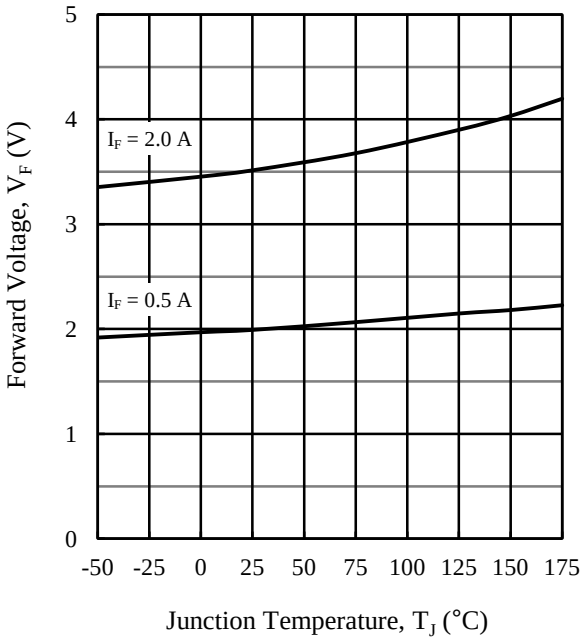


Figure 22. Diode Forward Voltage vs. Junction Temperature

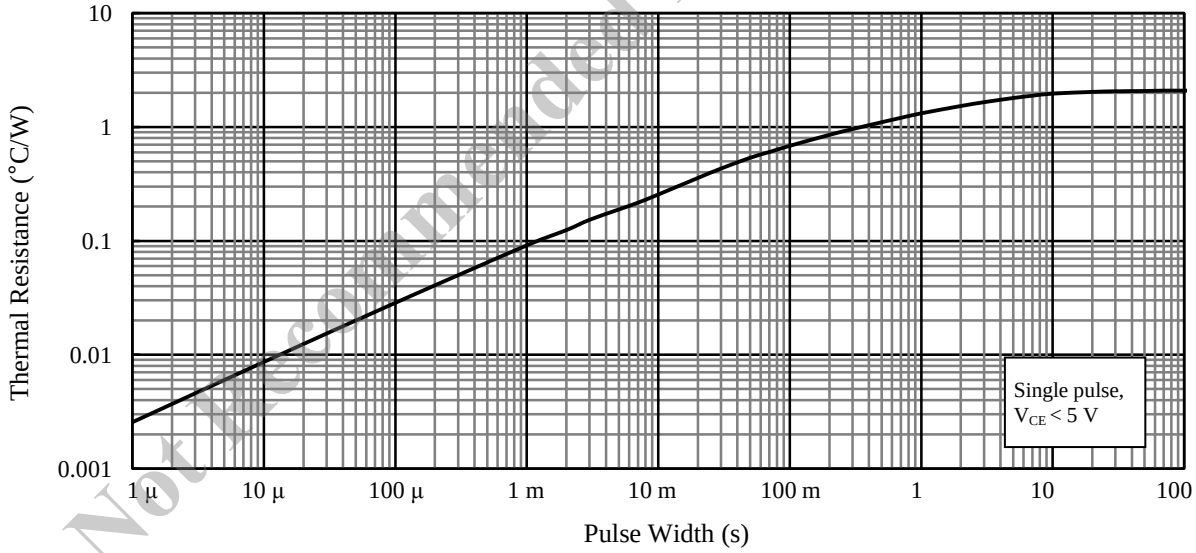
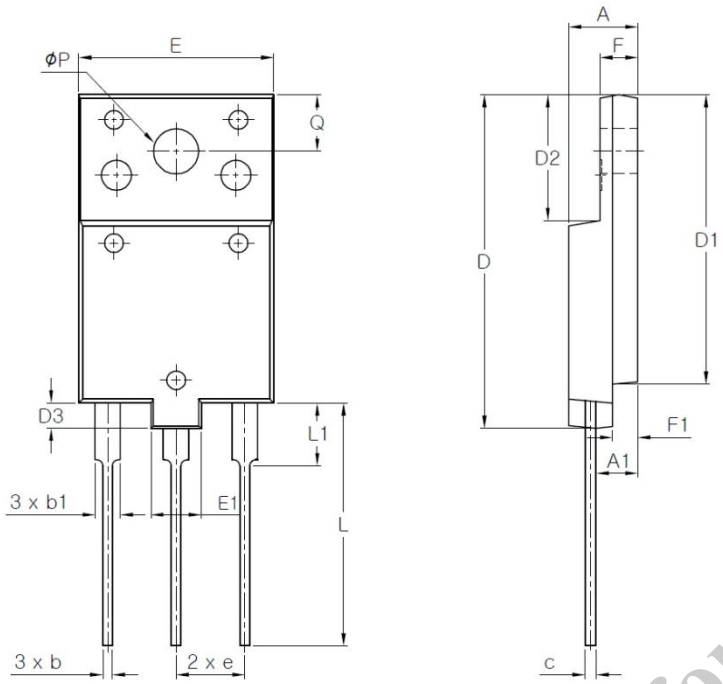


Figure 23. Transient Thermal Resistance

Physical Dimensions

● **TO3PF-3L**

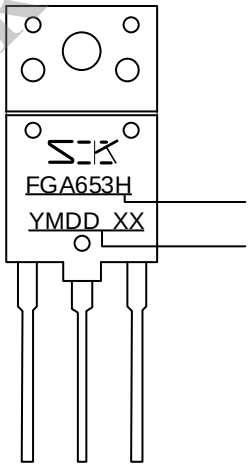


SYMBOL	MIN	NOM	MAX
A	5.30	5.50	5.70
A1	3.10	3.30	3.50
b	0.65	0.75	0.95
b1	1.80	2.00	2.20
c	0.80	0.90	1.10
D	26.30	26.50	26.70
D1	22.80	23.00	23.20
D2	9.80	10.00	10.20
D3	1.80	2.00	2.20
E	15.30	15.50	15.70
E1	3.80	4.00	4.20
e	5.25	5.45	5.65
F	2.80	3.00	3.20
F1	1.80	2.00	2.20
L	19.10	19.30	19.50
L1	4.80	5.00	5.20
Q	4.30	4.50	4.70
φP	3.40	3.60	3.80

NOTES:

- Dimensions in millimeters
- Bare lead frame: Pb-free (RoHS compliant)
- When soldering the products, be sure to minimize the working time within the following limits:
  Flow: 260 ± 5 °C / 10 ± 1 s, 2 times
  Soldering iron: 380 ± 10 °C / 3.5 ± 0.5 s, 1 time (Soldering should be at a distance of at least 1.5 mm from the body of the products.)
- Recommended screw torque: 0.686 N·m to 0.882 N·m (7 kgf·cm to 9 kgf·cm)

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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- No anti-radioactive ray design has been adopted for the Sanken Products.
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