# RGTH50TK65

**650V 25A Field Stop Trench IGBT**

Data Sheet

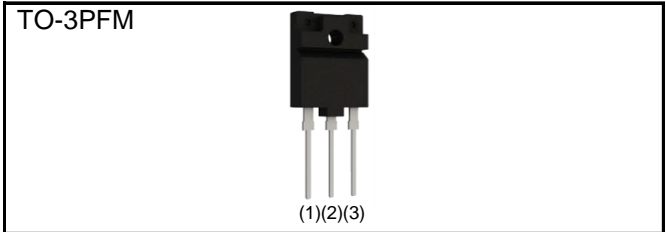| | |
|---|---|
| $V_{CES}$ | 650V |
| $I_{C(100°C)}$ | 16A |
| $V_{CE(sat) (Typ.)}$ | 1.6V @ $I_C$=25A |
| $P_D$ | 59W |

● **Features**

1) Low Collector - Emitter Saturation Voltage

2) High Speed Switching

3) Low Switching Loss & Soft Switching

4) Pb - free Lead Plating ; RoHS Compliant

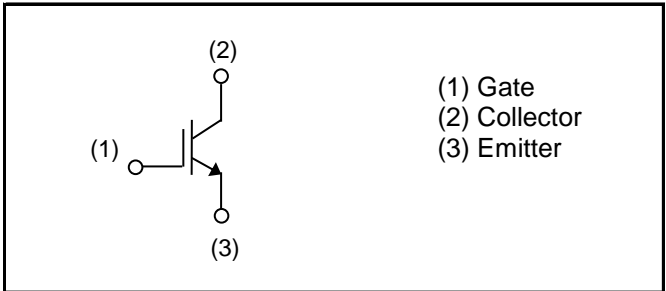● **Applications**

PFC

UPS

Power Conditioner

IH

● **Outline**

TO-3PFM

(1)(2)(3)

● **Inner Circuit**

(2)

(1)

(3)

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

● **Packaging Specifications**

| | Packaging | Tube |
|---|---|---|
| Type | Reel Size (mm) | - |
| | Tape Width (mm) | - |
| | Basic Ordering Unit (pcs) | 450 |
| | Packing Code | C11 |
| | Marking | RGTH50TK65 |

● **Absolute Maximum Ratings** (at $T_C$ = 25°C unless otherwise specified)

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Collector - Emitter Voltage | | $V_{CES}$ | 650 | V |
| Gate - Emitter Voltage | | $V_{GES}$ | ±30 | V |
| Collector Current | $T_C$ = 25°C | $I_C$ | 26 | A |
| | $T_C$ = 100°C | $I_C$ | 16 | A |
| Pulsed Collector Current | | $I_{CP}$ [*1] | 100 | A |
| Power Dissipation | $T_C$ = 25°C | $P_D$ | 59 | W |
| | $T_C$ = 100°C | $P_D$ | 29 | W |
| Operating Junction Temperature | | $T_j$ | −40 to +175 | °C |
| Storage Temperature | | $T_{stg}$ | −55 to +175 | °C |

*1 Pulse width limited by $T_{jmax}$.

●**Thermal Resistance**

| Parameter | Symbol | Values | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| Thermal Resistance IGBT Junction - Case | $R_{\theta(j\text{-}c)}$ | - | - | 2.51 | °C/W |

●**IGBT Electrical Characteristics** (at $T_j$ = 25°C unless otherwise specified)

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Collector - Emitter Breakdown Voltage | $BV_{CES}$ | $I_C$ = 10µA, $V_{GE}$ = 0V | 650 | - | - | V |
| Collector Cut - off Current | $I_{CES}$ | $V_{CE}$ = 650V, $V_{GE}$ = 0V | - | - | 10 | µA |
| Gate - Emitter Leakage Current | $I_{GES}$ | $V_{GE}$ = ±30V, $V_{CE}$ = 0V | - | - | ±200 | nA |
| Gate - Emitter Threshold Voltage | $V_{GE(th)}$ | $V_{CE}$ = 5V, $I_C$ = 17.5mA | 4.5 | 5.5 | 6.5 | V |
| Collector - Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_C$ = 25A, $V_{GE}$ = 15V<br>$T_j$ = 25°C | - | 1.6 | 2.1 | V |
| | | $T_j$ = 175°C | - | 2.1 | - | |

●**IGBT Electrical Characteristics** (at $T_j$ = 25°C unless otherwise specified)

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Input Capacitance | $C_{ies}$ | $V_{CE}$ = 30V | - | 1410 | - | pF |
| Output Capacitance | $C_{oes}$ | $V_{GE}$ = 0V | - | 57 | - | |
| Reverse Transfer Capacitance | $C_{res}$ | f = 1MHz | - | 22 | - | |
| Total Gate Charge | $Q_g$ | $V_{CE}$ = 300V | - | 49 | - | nC |
| Gate - Emitter Charge | $Q_{ge}$ | $I_C$ = 25A | - | 15 | - | |
| Gate - Collector Charge | $Q_{gc}$ | $V_{GE}$ = 15V | - | 19 | - | |
| Turn - on Delay Time | $t_{d(on)}$ | $I_C$ = 25A, $V_{CC}$ = 400V | - | 27 | - | ns |
| Rise Time | $t_r$ | $V_{GE}$ = 15V, $R_G$ = 10Ω | - | 38 | - | |
| Turn - off Delay Time | $t_{d(off)}$ | $T_j$ = 25°C | - | 94 | - | |
| Fall Time | $t_f$ | Inductive Load | - | 50 | - | |
| Turn - on Delay Time | $t_{d(on)}$ | $I_C$ = 25A, $V_{CC}$ = 400V | - | 27 | - | ns |
| Rise Time | $t_r$ | $V_{GE}$ = 15V, $R_G$ = 10Ω | - | 38 | - | |
| Turn - off Delay Time | $t_{d(off)}$ | $T_j$ = 175°C | - | 107 | - | |
| Fall Time | $t_f$ | Inductive Load | - | 65 | - | |
| Reverse Bias Safe Operating Area | RBSOA | $I_C$ = 100A, $V_{CC}$ = 520V $V_P$ = 650V, $V_{GE}$ = 15V $R_G$ = 60Ω, $T_j$ = 175°C | FULL SQUARE | | | - |

●**Electrical Characteristic Curves**

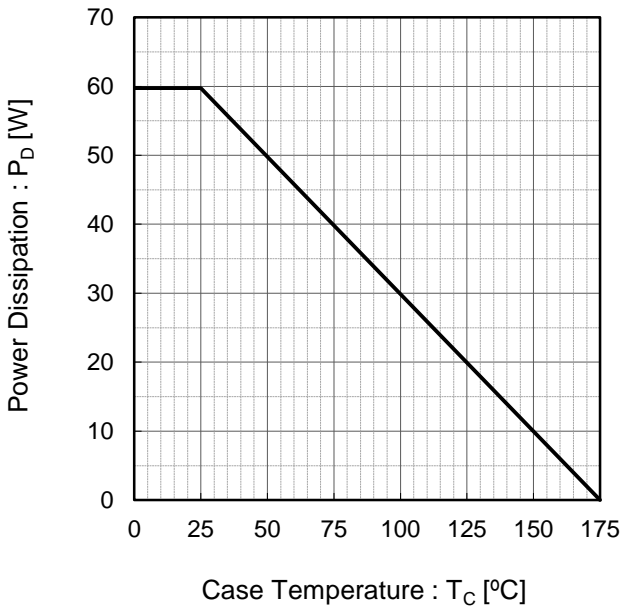Fig.1 Power Dissipation vs. Case Temperature

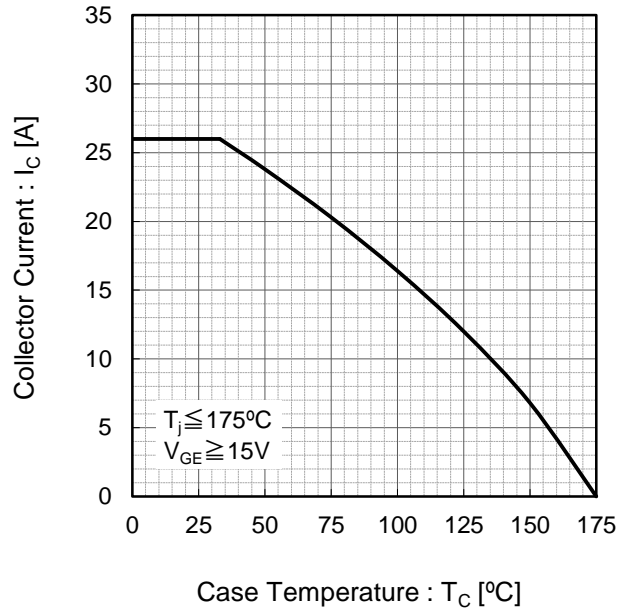Fig.2 Collector Current vs. Case Temperature

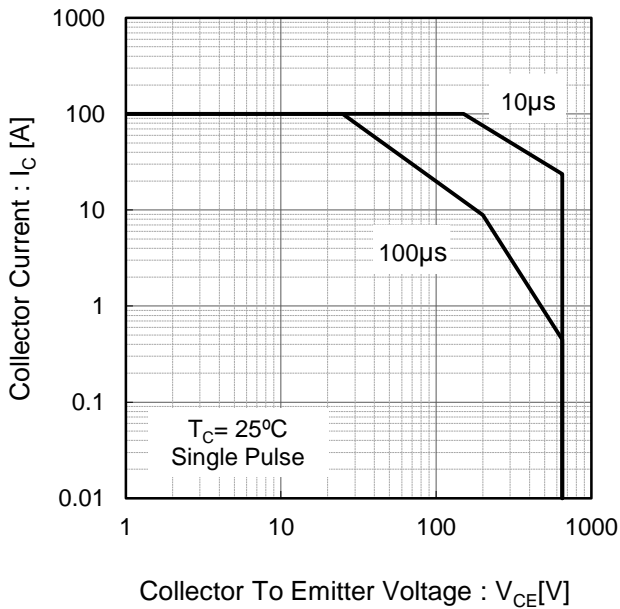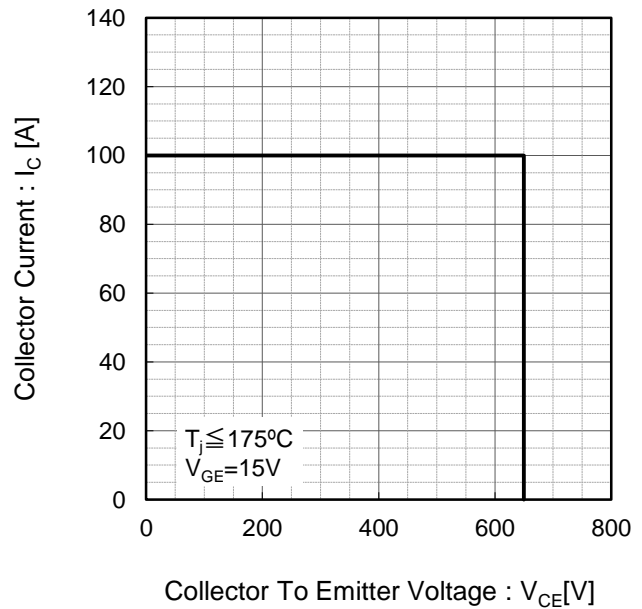Fig.3 Forward Bias Safe Operating Area

Fig.4 Reverse Bias Safe Operating Area

● **Electrical Characteristic Curves**
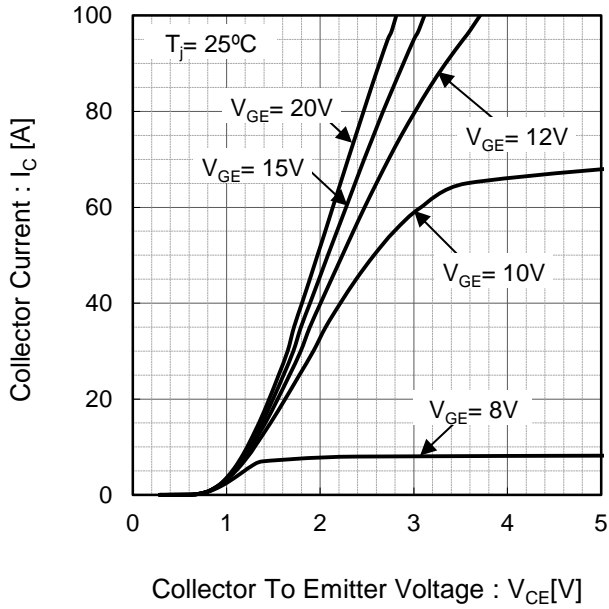
Fig.5 Typical Output Characteristics



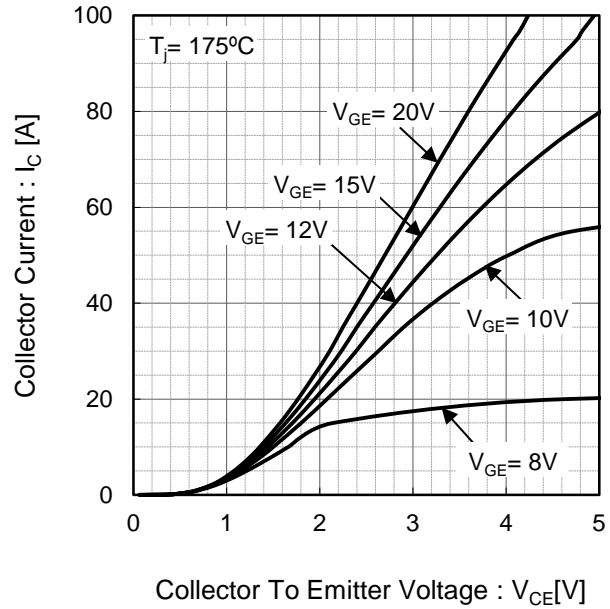Fig.6 Typical Output Characteristics
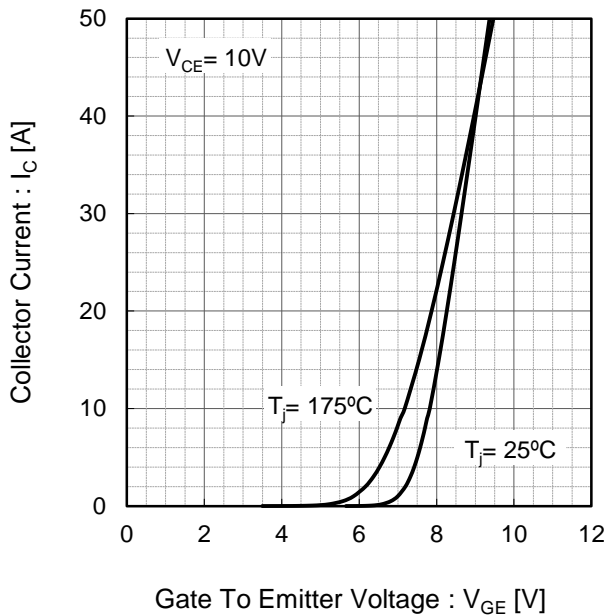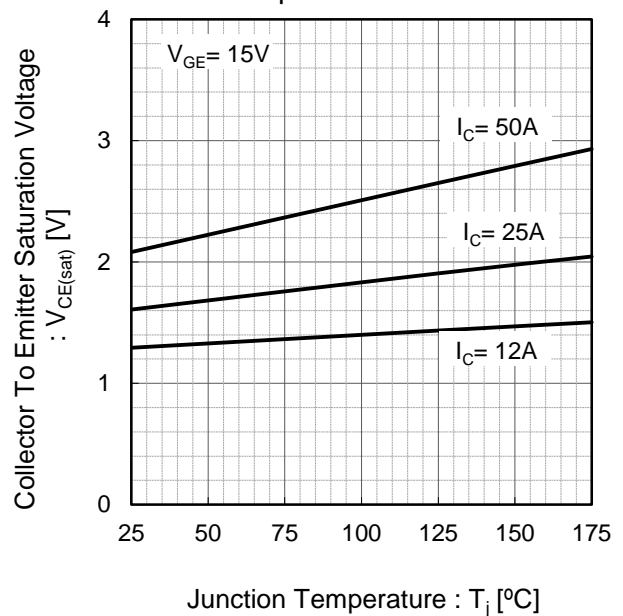


Fig.7 Typical Transfer Characteristics



Fig.8 Typical Collector To Emitter Saturation Voltage vs. Junction Temperature

## ●Electrical Characteristic Curves

Fig.9 Typical Collector To Emitter Saturation Voltage
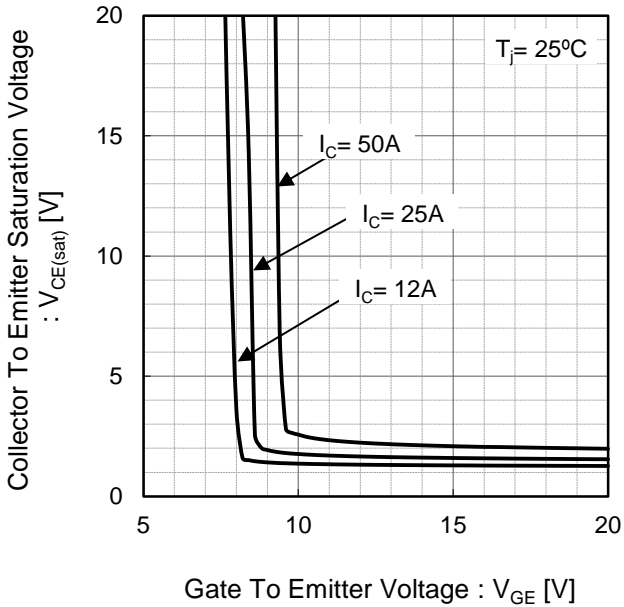vs. Gate To Emitter Voltage



Fig.10 Typical Collector To Emitter Saturation Voltage
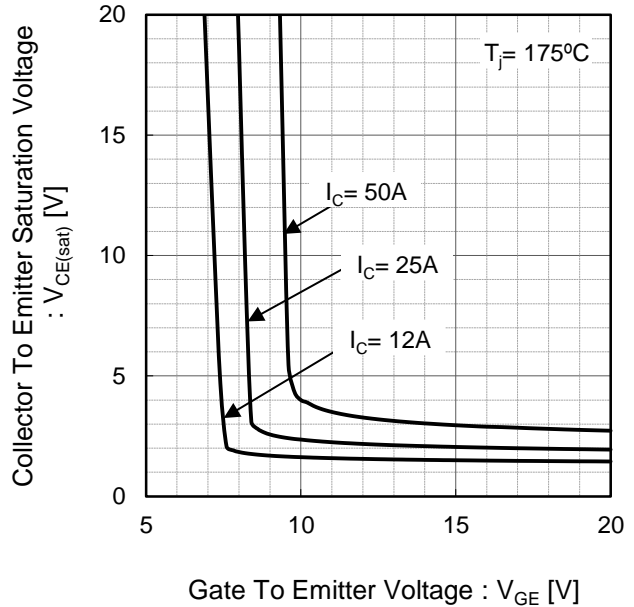vs. Gate To Emitter Voltage



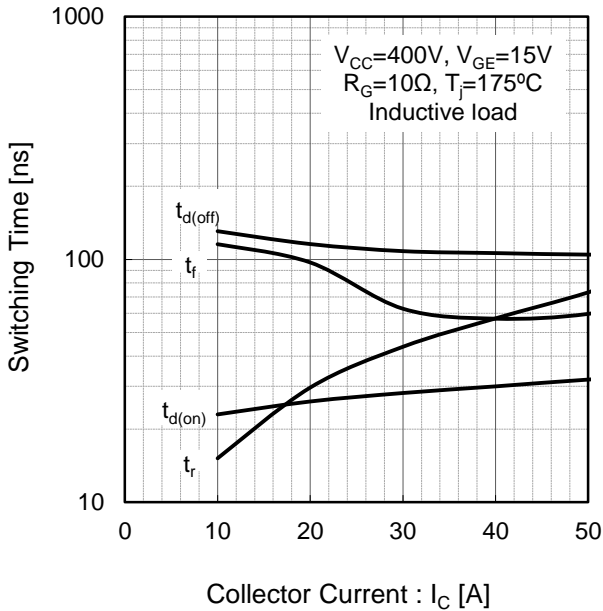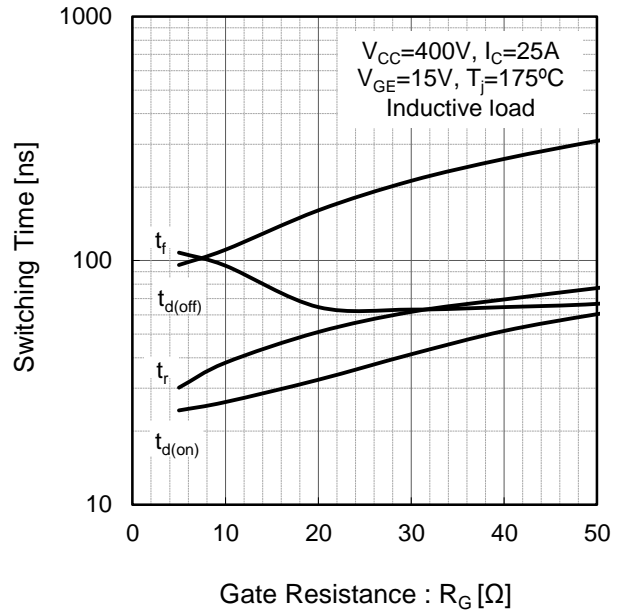Fig.11 Typical Switching Time
vs. Collector Current



Fig.12 Typical Switching Time
vs. Gate Resistance

● **Electrical Characteristic Curves**

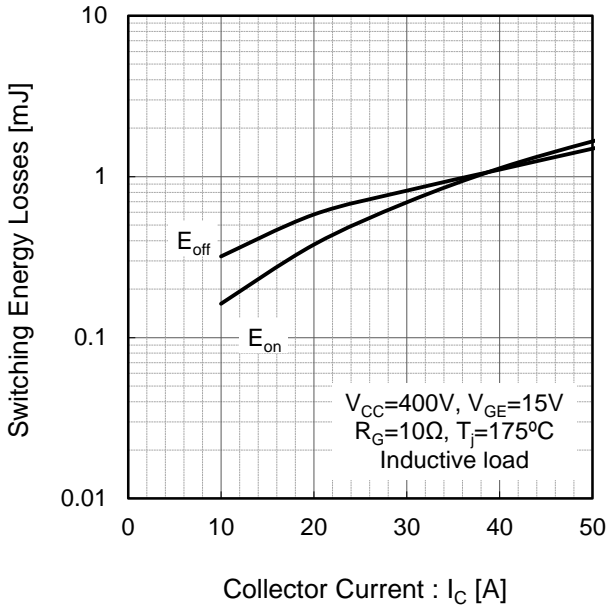Fig.13 Typical Switching Energy Losses vs. Collector Current

Switching Energy Losses [mJ]

$E_{off}$

$E_{on}$

$V_{CC}$=400V, $V_{GE}$=15V
$R_G$=10Ω, $T_j$=175ºC
Inductive load

Collector Current : $I_C$ [A]

Fig.14 Typical Switching Energy Losses vs. Gate Resistance

Switching Energy Losses [mJ]

$E_{off}$

$E_{on}$

$V_{CC}$=400V, $I_C$=25A
$V_{GE}$=15V, $T_j$=175ºC
Inductive load

Gate Resistance : $R_G$ [Ω]

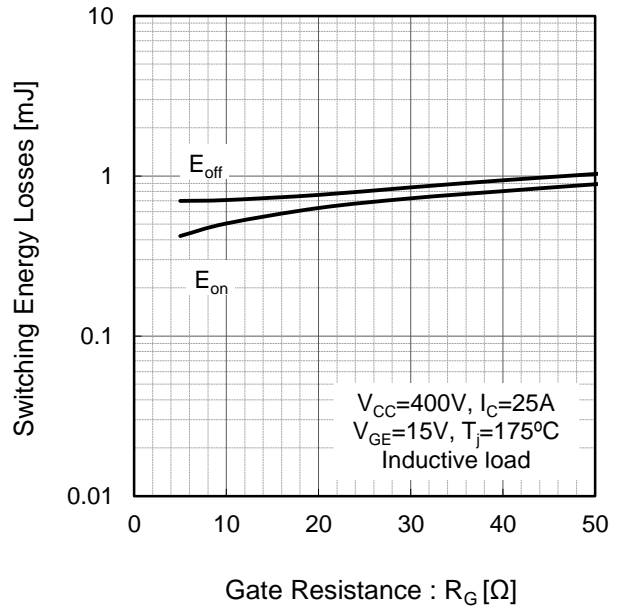Fig.15 Typical Capacitance vs. Collector To Emitter Voltage

Capacitance [pF]

Cies

Coes

Cres

f=1MHz
$V_{GE}$=0V
$T_j$=25ºC

Collector To Emitter Voltage : $V_{CE}$[V]
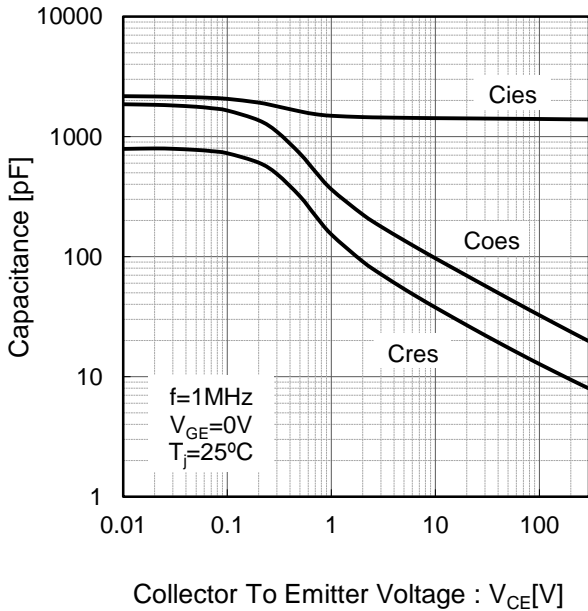
Fig.16 Typical Gate Charge

Gate To Emitter Voltage : $V_{GE}$ [V]

$V_{CC}$=300V
$I_C$=25A
$T_j$=25ºC

Gate Charge : $Q_g$ [nC]

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SEMICONDUCTOR

**2016.01 -  Rev.A**
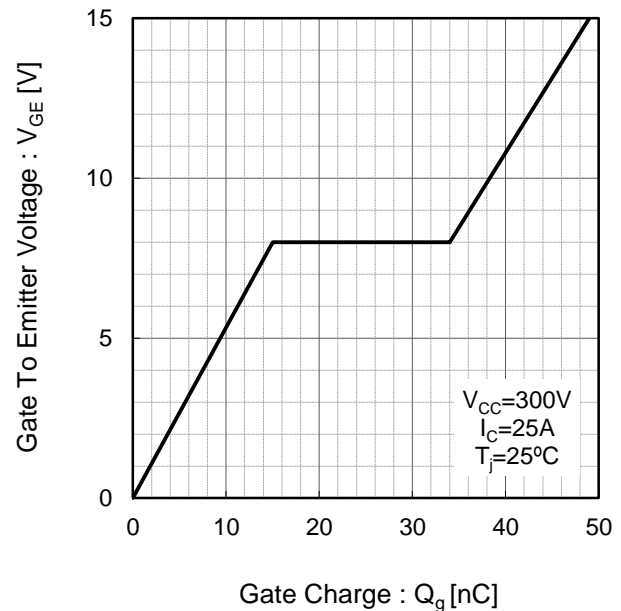
●**Electrical Characteristic Curves**

Fig.17 IGBT Transient Thermal Impedance



Pulse Width : t1[s]
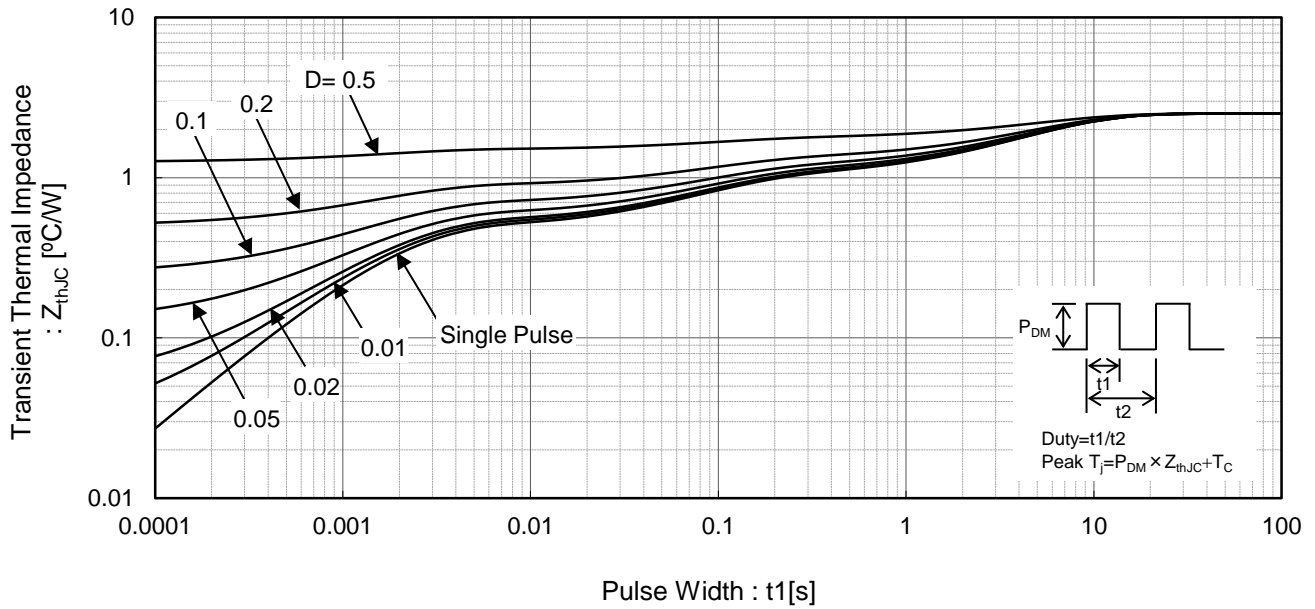
●**Inductive Load Switching Circuit and Waveform**
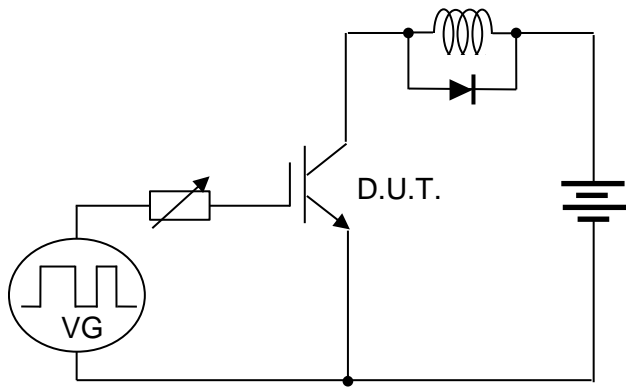


Fig.18 Inductive Load Circuit



Fig.19 Inductive Load Waveform

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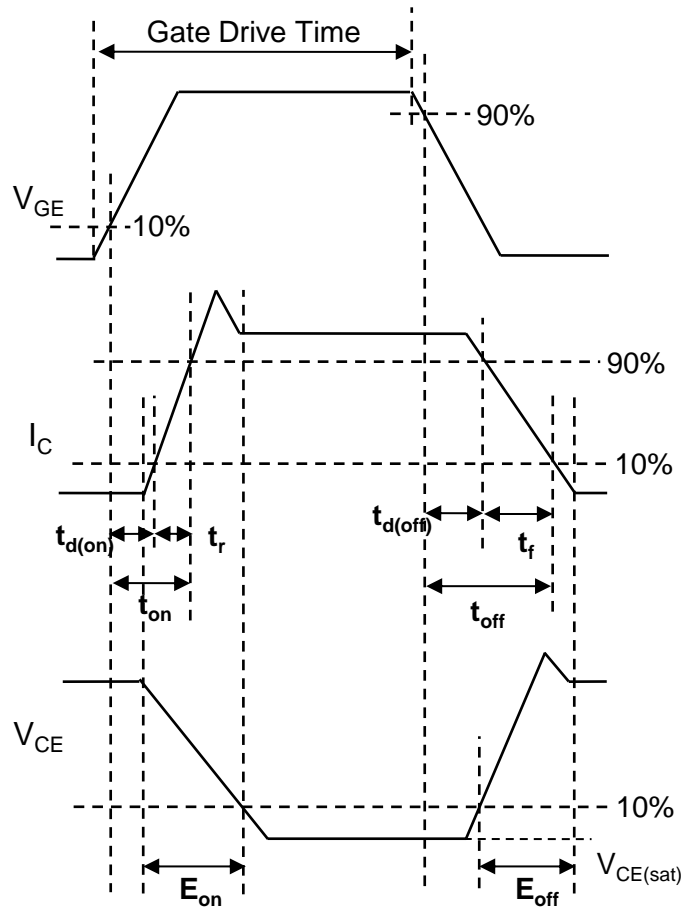**N o t e s**

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## RGTH50TK65 - Web Page

| Part Number | RGTH50TK65 |
|---|---|
| Package | TO-3PFM |
| Unit Quantity | 450 |
| Minimum Package Quantity | 450 |
| Packing Type | Tube |
| Constitution Materials List | inquiry |
| RoHS | Yes |