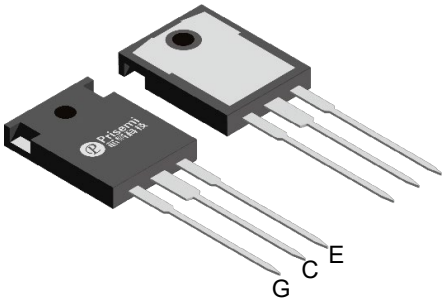
Prisemi®

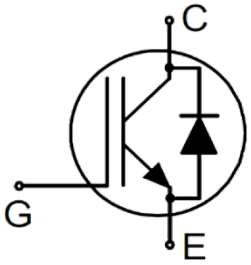
PI50F65T3H1A7

# Insulate-Gate Bipolar Transistor

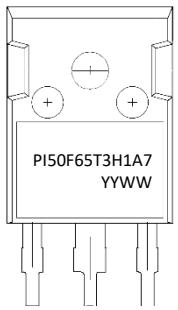
## Description




TO-247-3L




Circuit Diagram




Marking (Top View)

## Features

- Trench and field-stop technology
- Easy parallel switching capability
- High efficiency for inverters
- High ruggedness performance
- RoHS compliant

## Applications

- Industrial UPS
- Welding machine
- Solar converters
- Energy storage
- EV charger
- PFC applications
- Welding machines

## Absolute maximum rating@25℃

| Parameter | | Symbol | Value | Units |
|---|---|---|---|---|
| Collector-Emitter Voltage | | $V_{CE}$ | 650 | V |
| Gate-Emitter Voltage | | $V_{GE}$ | ±20 | V |
| Collector Current | $T_c$= 25℃ | $I_C$ | 100 | A |
| | $T_c$= 100℃ | | 50 | |
| Pulsed Collector Current | | $I_{CM}$ | 200 | A |
| Diode Forward Current | $T_c$= 100℃ | $I_F$ | 50 | A |
| Diode Maximum Forward Current | | $I_{FM}$ | 200 | A |
| Power Dissipation | $T_c$= 25℃ | $P_D$ | 312 | W |
| | $T_c$= 100℃ | | 156 | |
| Operating Junction Temperature | | $T_{VJ}$ | -40~+175 | ℃ |
| Storage Temperature | | $T_{STG}$ | -55~+150 | ℃ |

## Electrical characteristics per line@25℃ (unless otherwise specified)

| Parameter | Symbol | Conditions | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| Collector-Emitter Breakdown Voltage | $BV_{CE}$ | $V_{GE}$=0V, $I_C$=250uA | | 650 | - | - | V |
| C-E Leakage Current | $I_{CES}$ | $V_{GE}$=0V, $V_{CE}$=650V | | - | - | 50 | μA |
| G-E Leakage Current | $I_{GES}$ | $V_{GE}$=20V, $V_{GE}$=0V | | - | - | 100 | nA |
| | | $V_{GE}$=-20V, $V_{GE}$=0V | | - | - | -100 | |
| Gate-Emitter Threshold Voltage | $V_{GE(th)}$ | $I_C$=1mA, $V_{CE}$=$V_{GE}$ | | 5.0 | 5.4 | 5.6 | V |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_C$=50A, $V_{GE}$=15V | $T_{VJ}$=25℃ | - | 1.9 | - | V |
| | | | $T_{VJ}$=175℃ | - | 2.6 | - | |
| Diode forward voltage | $V_F$ | $I_C$=50A | $T_{VJ}$=25℃ | - | 2.5 | - | V |
| | | | $T_{VJ}$=175℃ | - | 2.0 | - | |
| Input Capacitance | $C_{ies}$ | $V_{CE}$=30V, $V_{GE}$=0V, f=1MHz | | - | 4820 | - | pF |
| Output Capacitance | $C_{oes}$ | | | - | 136 | - | |
| Reverse Transfer Capacitance | $C_{res}$ | | | - | 37 | - | |
| Total Gate Charge | $Q_g$ | $V_{CC}$=520V, $I_C$=50A, $V_{GE}$=15V | | - | 158 | - | nC |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{CC}$=400V, $I_C$=50A, $V_{GE}$=0/15V, $R_G$=10Ω, Inductive Load | | - | 50 | - | ns |
| Rise Time | $t_r$ | | | - | 81 | - | |
| Turn-off Delay Time | $t_{d(off)}$ | | | - | 190 | - | |
| Fall Time | $t_f$ | | | - | 59 | - | |
| Turn-on Energy Loss | $E_{on}$ | $V_{CC}$=400V, $I_C$=50A, $V_{GE}$=0/15V, $R_G$=10Ω, Inductive Load | | - | 1.7 | - | mJ |
| Turn-off Energy Loss | $E_{off}$ | | | - | 0.9 | - | |
| Total Switching Loss | $E_{st}$ | | | - | 2.6 | - | |
| Diode Reverse Recovery Time | $T_{rr}$ | $V_R$=400V, $I_F$=50A, di/dt=-800A/μs | | - | 75 | - | ns |
| Diode Reverse Recovery Current | $I_{rm}$ | | | - | 14 | - | A |
| Diode Reverse Recovery Charge | $Q_{rr}$ | | | - | 482 | - | nC |

## Electrical characteristics per line@175℃ (unless otherwise specified)

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Turn-on Delay Time | $t_{d(on)}$ | $V_{CC}$=400V, $I_C$=50A, $V_{GE}$=0/15V, $R_G$=10Ω, Inductive Load | - | 46 | - | ns |
| Rise Time | $t_r$ | | - | 83 | - | |
| Turn-off Delay Time | $t_{d(off)}$ | | - | 205 | - | |
| Fall Time | $t_f$ | | - | 66 | - | |
| Turn-on Energy Loss | $E_{on}$ | $V_{CC}$=400V, $I_C$=50A, $V_{GE}$=0/15V, $R_G$=10Ω, Inductive Load | - | 2.5 | - | mJ |
| Turn-off Energy Loss | $E_{off}$ | | - | 1.0 | - | |
| Total Switching Loss | $E_{st}$ | | - | 3.5 | - | |
| Diode Reverse Recovery Time | $T_{rr}$ | $V_R$=400V, $I_F$=50A, di/dt=-800A/μs | - | 114 | - | ns |
| Diode Reverse Recovery Current | $I_{rm}$ | | - | 22 | - | A |
| Diode Reverse Recovery Charge | $Q_{rr}$ | | - | 1384 | - | nC |

## Thermal Resistance

| Parameter | Symbol | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Thermal Resistance, Junction to case for IGBT | $R_{\theta JC}$ | - | - | 0.48 | K/W |
| Thermal Resistance, Junction to case for Diode | $R_{\theta JC}$ | - | - | 0.90 | K/W |
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | - | - | 40 | K/W |

## Typical Characteristics

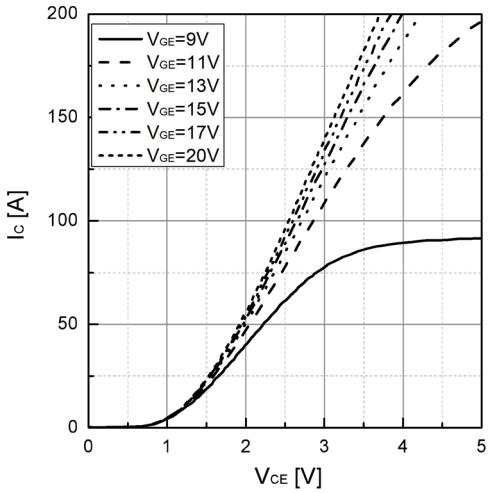



**Fig 1. Typical Output characteristics ($T_{VJ}$=25℃)**

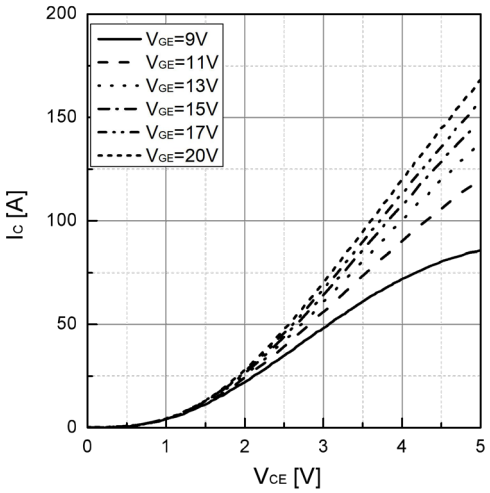



**Fig 2. Typical Output characteristics ($T_{VJ}$=175℃)**

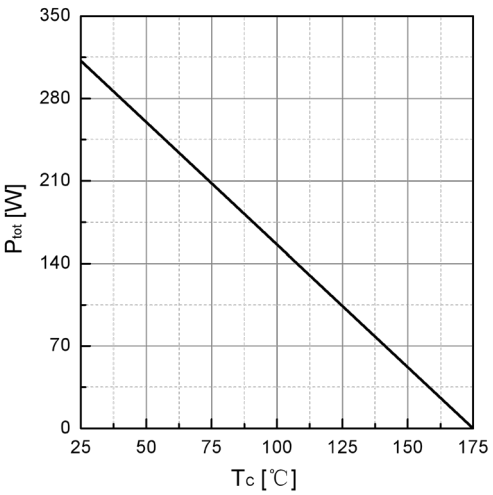



**Fig 3. Power dissipation vs. $T_C$**

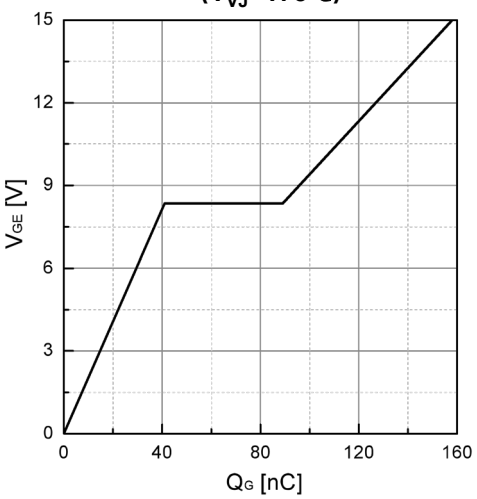



**Fig 4. Typical Gate charge**

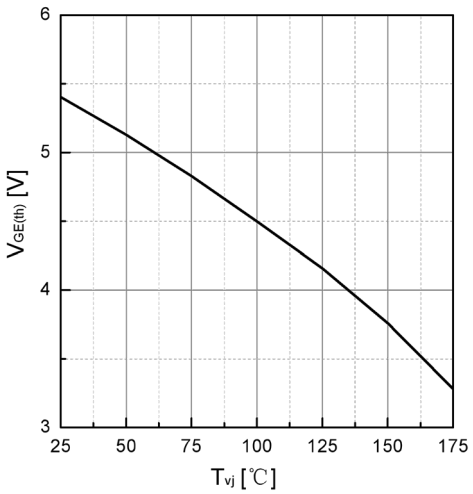



**Fig 5. Typical $V_{GE(th)}$ vs. $T_{VJ}$ ($I_C$=1mA)**

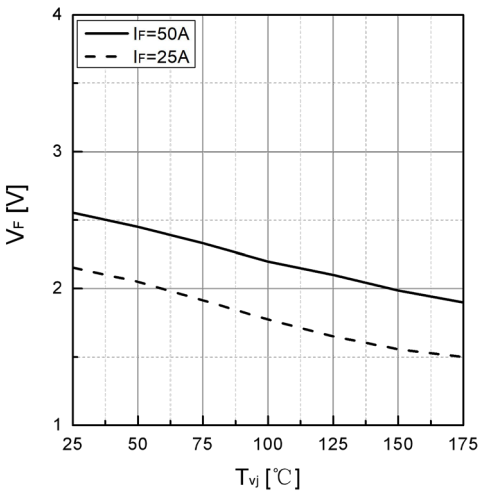



**Fig 6. Typical $V_F$ vs. $T_{VJ}$**

## Typical Characteristics

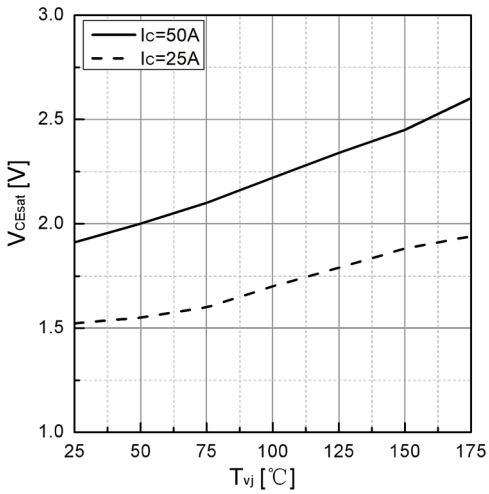



Fig 7. Typical $V_{CE(sat)}$ vs. $T_{VJ}$

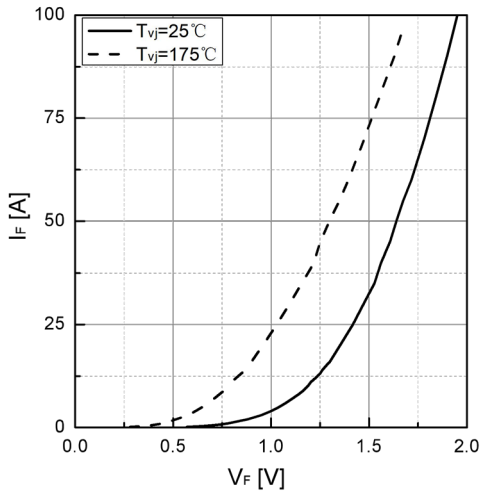



Fig 8. Typical $I_F$ vs. $V_F$

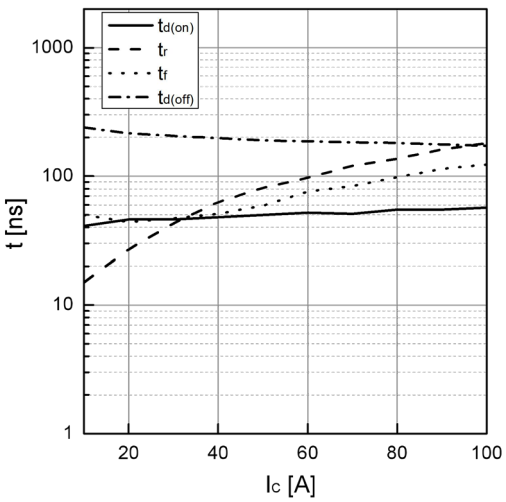



Fig 9. Typical switching time vs. $I_C$

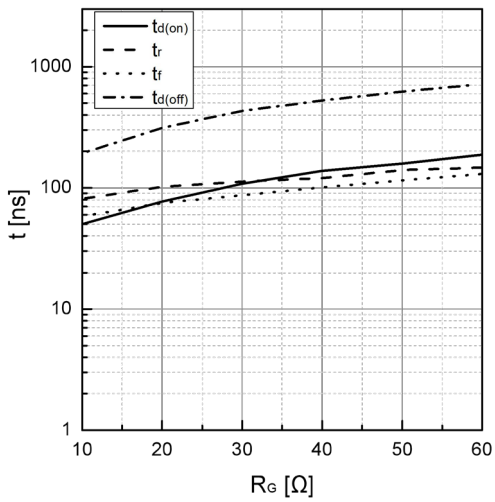



Fig 10. Typical switching times vs $R_G$

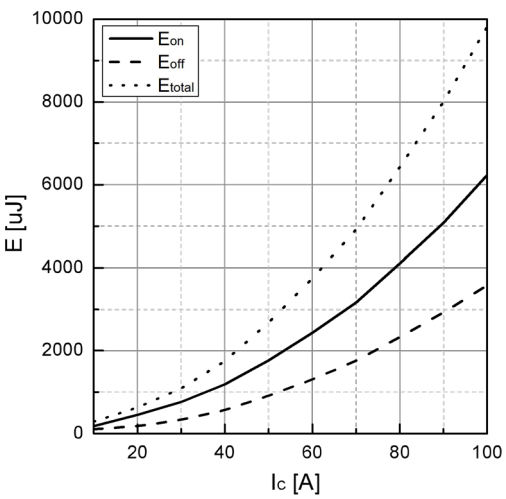



Fig 11. Typical switching energy losses vs. $I_C$

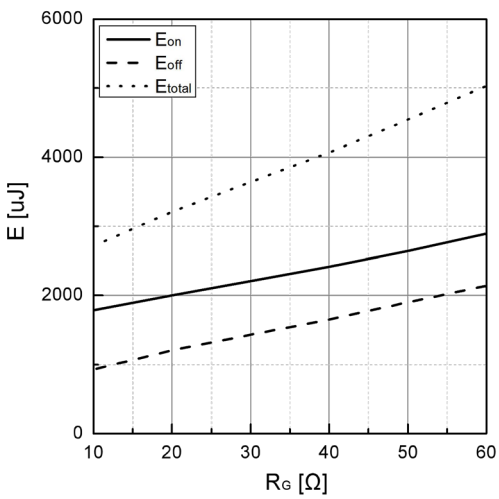



Fig 12. Typical switching energy losses vs. $R_G$

## Typical Characteristics

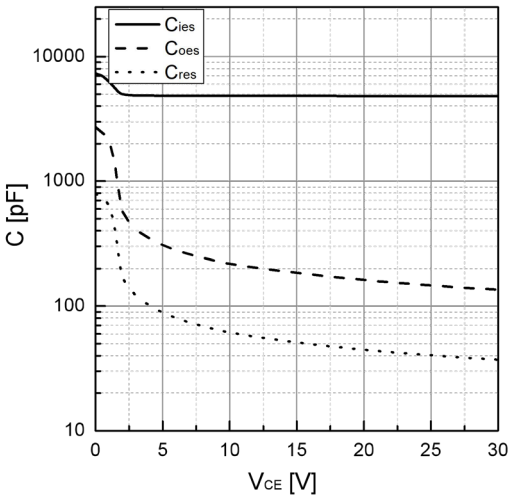



**Fig 13. Typical capacitance vs. $V_{CE}$ (f=1Mhz, $V_{GE}$=0V)**

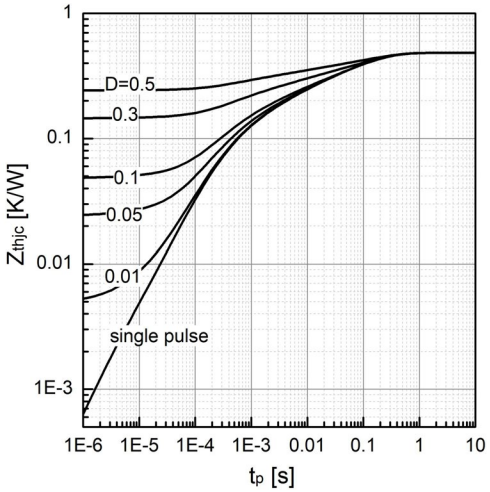
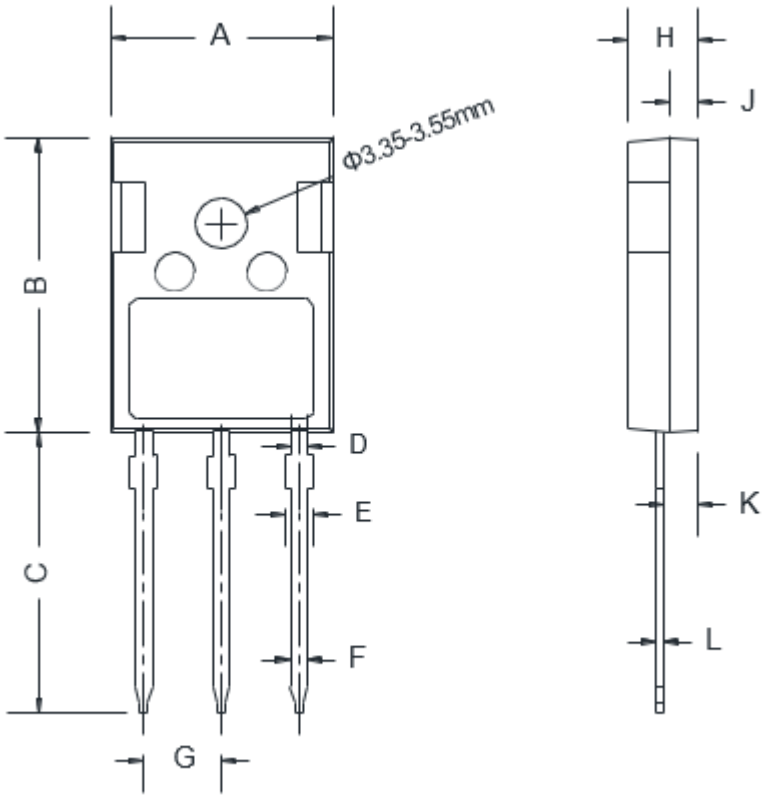



**Fig 14. Transient thermal impedance of IGBT**

## Product Dimension (TO-247-3L)




| Ref. | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 15.50 | 15.80 | 16.10 | 0.610 | 0.622 | 0.634 |
| B | 20.80 | 21.00 | 22.20 | 0.819 | 0.827 | 0.835 |
| C | 19.70 | 20.00 | 20.30 | 0.776 | 0.787 | 0.799 |
| D | 1.80 | 2.00 | 2.20 | 0.071 | 0.079 | 0.087 |
| E | 1.90 | 2.10 | 2.30 | 0.075 | 0.083 | 0.091 |
| F | 1.00 | 1.20 | 1.40 | 0.039 | 0.047 | 0.055 |
| G | - | 5.44 | - | - | 0.214 | - |
| H | 4.80 | 5.00 | 5.20 | 0.189 | 0.197 | 0.205 |
| J | 1.90 | 2.00 | 2.10 | 0.075 | 0.079 | 0.083 |
| K | 2.20 | 2.35 | 2.50 | 0.087 | 0.093 | 0.098 |
| L | 0.41 | 0.60 | 0.79 | 0.016 | 0.024 | 0.031 |

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