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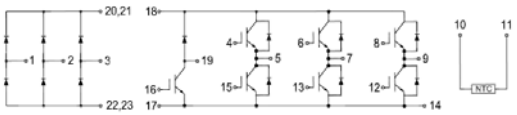
# GTS25PI120T5H-T4

IGBT Module

## Features：

- Field Stop Trench Gate IGBT
- Short Circuit Rated ＞10μs
- Low Saturation Voltage
- Low Switching Loss
- 100% RBSOA Tested（2×Ic）
- Low Stray Inductance
- Lead Free, Compliant with RoHS Requirement




## Applications：

- Industrial Inverters
- Servo Applications

## IGBT, Inverter

**Maximum Rated Values of IGBT**($T_C$=25℃ unless otherwise specified)

| | | | | |
|---|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Blocking Voltage | | 1200 | V |
| $V_{GES}$ | Gate-Emitter Voltage | | ±20 | V |
| $I_C$ | Continuous Collector Current | $T_C$=80℃ | 25 | A |
| | | $T_C$=25℃ | 50 | A |
| $I_{CM}$ | Repetitive Peak Collector Current | $T_J$=150℃ | 50 | A |
| $t_{SC}$ | Short Circuit Withstand Time | | >10 | μs |
| $P_D$ | Maximum Power Dissipation per IGBT | $T_C$=25℃<br>$T_{Jmax}$=150℃ | 195 | W |

## Electrical Characteristics of IGBT ($T_C$=25℃ unless otherwise specified)

Static Characteristics

| Symbol | Description | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{GE(th)}$ | Gate-Emitter Threshold Voltage | $I_C$=1mA, $V_{CE}$=$V_{GE}$ | | 5.0 | 5.7 | 6.5 | V |
| $V_{CEsat(Terminal)}$ | Collector-Emitter Saturation Voltage | $I_C$= 25A, $V_{GE}$ = 15V | $T_J$=25℃ | | 1.70 | | V |
| | | | $T_J$=125℃ | | 2.10 | | V |
| | | | $T_J$=150℃ | | 2.20 | | V |
| $I_{CES}$ | Collector-Emitter Leakage Current | $V_{GE}$=0V, $V_{CE}$=$V_{CES}$, $T_J$=25℃ | | | | 1 | mA |
| $I_{GES}$ | Gate-Emitter Leakage Current | $V_{GE}$= ±20V, $V_{CE}$= 0V, $T_J$=25℃ | | | | 200 | nA |
| $C_{ies}$ | Input Capacitance | $V_{CE}$=25V, $V_{GE}$=0V, f=1MHz | | | 2.23 | | nF |
| $C_{oes}$ | Output Capacitance | | | | 0.36 | | nF |
| $C_{res}$ | Reverse Transfer Capacitance | | | | 0.07 | | nF |

Switching Characteristics

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{CC}$ = 600V,$I_C$ =25A, $R_{Gon}$ = 15Ω,$V_{GE}$ = ±15V, Inductive Load | $T_J$=25℃ | | 107 | | ns |
| | | | $T_J$=125℃ | | 104 | | |
| | | | $T_J$=150℃ | | 103 | | |
| $t_r$ | Rise Time | | $T_J$=25℃ | | 22 | | ns |
| | | | $T_J$=125℃ | | 22 | | |
| | | | $T_J$=150℃ | | 23 | | |
| $t_{d(off)}$ | Turn-off Delay Time | $V_{CC}$ = 600V,$I_C$ =25A, $R_{Goff}$ = 15Ω,$V_{GE}$ = ±15V, Inductive Load | $T_J$=25℃ | | 195 | | ns |
| | | | $T_J$=125℃ | | 206 | | |
| | | | $T_J$=150℃ | | 209 | | |
| $t_f$ | Fall Time | | $T_J$=25℃ | | 194 | | ns |
| | | | $T_J$=125℃ | | 237 | | |
| | | | $T_J$=150℃ | | 249 | | |
| $E_{on}$ | Turn-on Switching Loss | $V_{CC}$ = 600V,$I_C$ =25A, $R_{Gon}$ = 15Ω,$V_{GE}$ = ±15V, di/dt=889A/μs ( $T_J$=150℃) Inductive Load | $T_J$=25℃ | | 1.59 | | mJ |
| | | | $T_J$=125℃ | | 2.04 | | |
| | | | $T_J$=150℃ | | 2.19 | | |
| $E_{off}$ | Turn-off Switching Loss | $V_{CC}$ = 600V,$I_C$ =25A, $R_{Goff}$ = 15Ω,$V_{GE}$ = ±15V, du/dt=1451V/μs ( $T_J$=150℃) Inductive Load | $T_J$=25℃ | | 0.56 | | mJ |
| | | | $T_J$=125℃ | | 0.83 | | |
| | | | $T_J$=150℃ | | 0.97 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge | $V_{GE}$=+15V…-15V | | 512 | | nC |
| RBSOA | $I_C$=50A,$V_{CC}$=1050V,Vp=1200V, $R_{Goff}$ = 15Ω, $V_{GE}$=+15V to 0V, $T_J$ =150°C | | | Trapezoid | | |
| $I_{sc}$ | SC Data | $V_{CC}$=600V tp=10us $V_{GE}$=±15V, $R_G$=51ohm, $T_J$=25℃ | | 188 | | A |
| $R_{\theta JC}$ | IGBT Thermal Resistance: Junction-To-Case(per leg) | | | 0.64 | | ℃/W |

## Diode, Inverter
## Maximum Rated Values ($T_C$=25℃ unless otherwise specified)

| | | | |
|---|---|---|---|
| $V_{RRM}$ | Repetitive Peak Reverse Voltage | 1200 | V |
| $I_F$ | Diode Continuous Forward Current | 25 | A |
| $I_{FM}$ | Diode Maximum Forward Current | 50 | A |

## Electrical Characteristics of FWD ($T_C$=25℃ unless otherwise specified)

| Symbol | Description | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{FM(Terminal)}$ | Forward Voltage | $I_F$=25A | $T_J$=25℃ | | 1.70 | | V |
| | | | $T_J$=125℃ | | 1.80 | | |
| | | | $T_J$=150℃ | | 1.70 | | |
| $t_{rr}$ | Reverse Recovery Time | $I_F$=25A, -diF/dt=1090A/μs( $T_J$=150℃) $V_R$= 600V, $V_{GE}$ = -15V | $T_J$=25℃ | | 242 | | ns |
| | | | $T_J$=125℃ | | 261 | | |
| | | | $T_J$=150℃ | | 265 | | |
| $I_{rr}$ | Peak Reverse Recovery Current | | $T_J$=25℃ | | 29.4 | | A |
| | | | $T_J$=125℃ | | 35.3 | | |
| | | | $T_J$=150℃ | | 37.2 | | |
| $Q_{rr}$ | Reverse Recovery Charge | | $T_J$=25℃ | | 2.85 | | μC |
| | | | $T_J$=125℃ | | 3.97 | | |
| | | | $T_J$=150℃ | | 4.32 | | |
| $E_{rec}$ | Reverse Recovery Energy | | $T_J$=25℃ | | 0.93 | | mJ |
| | | | $T_J$=125℃ | | 1.81 | | |
| | | | $T_J$=150℃ | | 2.19 | | |
| $R_{\theta JC}$ | Diode Thermal Resistance: Junction-To-Case (per leg) | | | | 0.80 | | ℃/W |

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## IGBT, Brake-Chopper

**Maximum Rated Values** ($T_C$=25℃unless otherwise specified)

| | | | | |
|---|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Blocking Voltage | | 1200 | V |
| $V_{GES}$ | Gate-Emitter Voltage | | ±20 | V |
| $I_C$ | Continuous Collector Current | $T_C$=80℃ | 15 | A |
| | | $T_C$=25℃ | 30 | A |
| $I_{CM}$ | Repetitive Peak Collector Current | $T_J$=150℃ | 30 | A |
| $t_{SC}$ | Short Circuit Withstand Time | | >10 | μs |
| $P_D$ | Maximum Power Dissipation per IGBT | $T_C$=25℃<br>$T_{Jmax}$=150℃ | 160 | W |

## Electrical Characteristics of IGBT ($T_C$=25℃ unless otherwise specified)

Static Characteristics

| Symbol | Description | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{GE(th)}$ | Gate-Emitter Threshold Voltage | $I_C$=1mA, $V_{CE}$=$V_{GE}$ | | 5.0 | 5.7 | 6.5 | V |
| $V_{CEsat(Terminal)}$ | Collector-Emitter Saturation Voltage | $I_C$= 15A, $V_{GE}$ = 15V | $T_J$=25℃ | | 1.60 | | V |
| | | | $T_J$=125℃ | | 1.90 | | V |
| $I_{CES}$ | Collector-Emitter Leakage Current | $V_{GE}$=0V, $V_{CE}$=$V_{CES}$, $T_J$=25℃ | | | | 1 | mA |
| $I_{GES}$ | Gate-Emitter Leakage Current | $V_{GE}$= ±20V, $V_{CE}$= 0V, $T_J$=25℃ | | | | 200 | nA |
| $C_{ies}$ | Input Capacitance | $V_{CE}$=25V, $V_{GE}$=0V, f=1MHz | | | 1.67 | | nF |
| $C_{oes}$ | Output Capacitance | | | | 0.26 | | nF |
| $C_{res}$ | Reverse Transfer Capacitance | | | | 0.05 | | nF |

Switching Characteristics

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{CC}$ = 600V,$I_C$ =15A, $R_{Gon}$ = 20Ω,$V_{GE}$ = ±15V, Inductive Load | $T_J$=25℃ | | 105 | | ns |
| | | | $T_J$=125℃ | | 96 | | |
| $t_r$ | Rise Time | | $T_J$=25℃ | | 26 | | ns |
| | | | $T_J$=125℃ | | 24 | | |
| $t_{d(off)}$ | Turn-off Delay Time | $V_{CC}$ = 600V,$I_C$ =15A, $R_{Goff}$ = 20Ω,$V_{GE}$ = ±15V, Inductive Load | $T_J$=25℃ | | 192 | | ns |
| | | | $T_J$=125℃ | | 201 | | |
| $t_f$ | Fall Time | | $T_J$=25℃ | | 234 | | ns |
| | | | $T_J$=125℃ | | 260 | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $E_{on}$ | Turn-on Switching Loss | $V_{CC}$ = 600V,$I_C$ =15A, $R_{Gon}$ = 20Ω,$V_{GE}$ = ±15V, di/dt=498A/μs ( $T_J$=125℃) Inductive Load | $T_J$=25℃ | | 1.17 | | mJ |
| | | | $T_J$=125℃ | | 1.31 | | |
| $E_{off}$ | Turn-off Switching Loss | $V_{CC}$ = 600V,$I_C$ =15A, $R_{Goff}$ = 20Ω,$V_{GE}$ = ±15V, du/dt=2314V/μs ( $T_J$=125℃) Inductive Load | $T_J$=25℃ | | 0.29 | | mJ |
| | | | $T_J$=125℃ | | 0.32 | | |
| $Q_g$ | Total Gate Charge | $V_{GE}$=+15V…-15V | | | 454 | | nC |
| RBSOA | $I_C$=30A,$V_{CC}$=1050V,Vp=1200V, $R_{Goff}$ = 20Ω, $V_{GE}$=+15V to 0V, $T_J$ =150°C | | | Trapezoid | | | |
| SCSOA | $V_{CC}$=600V, $V_{GE}$=15V, $T_J$ =150°C | | | 10 | | | μs |
| $R_{\theta JC}$ | IGBT Thermal Resistance: Junction-To-Case(per leg) | | | | 0.78 | | ℃/W |

## Diode, Brake-Chopper

**Maximum Rated Values** ($T_C$=25℃unless otherwise specified)

| | | | |
|---|---|---|---|
| $V_{RRM}$ | Repetitive Peak Reverse Voltage | 1200 | V |
| $I_F$ | Diode Continuous Forward Current | 15 | A |
| $I_{FM}$ | Diode Maximum Forward Current | 30 | A |

**Electrical Characteristics of FWD** ($T_C$=25℃unless otherwise specified)

| Symbol | Description | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{FM(Terminal)}$ | Forward Voltage | $I_F$=15A | $T_J$=25℃ | | 1.60 | | V |
| | | | $T_J$=125℃ | | 1.70 | | |
| $t_{rr}$ | Reverse Recovery Time | $I_F$=15A, -diF/dt=488A/μs( $T_J$=125℃) $V_R$= 600V, $V_{GE}$ = -15V | $T_J$=25℃ | | 241 | | ns |
| | | | $T_J$=125℃ | | 261 | | |
| $I_{rr}$ | Peak Reverse Recovery Current | | $T_J$=25℃ | | 21.9 | | A |
| | | | $T_J$=125℃ | | 24.7 | | |
| $Q_{rr}$ | Reverse Recovery Charge | | $T_J$=25℃ | | 1.82 | | μC |
| | | | $T_J$=125℃ | | 2.37 | | |
| $E_{rec}$ | Reverse Recovery Energy | $I_F$=15A, -diF/dt=488A/μs( $T_J$=125℃) $V_R$= 600V, $V_{GE}$ = -15V | $T_J$=25℃ | | 0.74 | | mJ |
| | | | $T_J$=125℃ | | 1.28 | | |
| $R_{\theta JC}$ | Diode Thermal Resistance: Junction-To-Case (per leg) | | | | 1.28 | | ℃/W |

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## Diode, Rectifier

**Maximum Rated Values** ($T_C$=25℃unless otherwise specified)

| | | | | |
|---|---|---|---|---|
| $V_{RRM}$ | Repetitive Peak Reverse Voltage | $T_J$ =25℃ | 1800 | V |
| $I_{FRMSM}$ | Maximum RMS Forward Current per Chip | $T_J$ =80℃ | 35 | A |
| $I_{RMSM}$ | Maximum RMS Current at Rectifier Output | $T_J$ =80℃ | 45 | A |
| $I_{FSM}$ | Surge Current @$t_p$=10 ms | $T_J$ =25℃ | 280 | A |
| | | $T_J$ =150℃ | 250 | |
| $I^2t$ | I²t - value | $T_J$ =25℃ | 500 | $A^2s$ |
| | | $T_J$ =150℃ | 370 | |

**Electrical Characteristics of Diode** ($T_C$=25℃unless otherwise specified)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $V_F$ | Forward Voltage | $I_F$ = 25A | $T_J$ =25℃ | | 1.10 | | V |
| | | | $T_J$=125℃ | | 1.00 | | |
| | | | $T_J$ =150℃ | | 1.00 | | |
| $I_R$ | Reverse Current | $V_R$=1600V | $T_J$ =25℃ | | | 1 | mA |
| $R_{\theta JC}$ | Junction-To-Case Diode | | | | 0.90 | | ℃/W |

**Internal NTC-Thermistor Characteristics**

| | | | | |
|---|---|---|---|---|
| $R_{25}$ | $T_C$ =25℃ | 5 | | kΩ |
| △R/R | $T_C$ =100℃，$R_{100}$ =481Ω | | ±5 | % |
| $P_{25}$ | $T_C$ =25℃ | 50 | | mW |
| $B_{25/50}$ | $R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$ | 3380 | | K |
| $B_{25/80}$ | $R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15K))]$ | 3440 | | K |

## Module

| Symbol | Description | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{iso}$ | Isolation Voltage (All Terminals Shorted) | f = 50Hz, 1minute | 2500 | | | V |
| $L_{sCE}$ | Stray Inductance Module | | | 60 | | nH |
| $T_J$ | Maximum Junction Temperature | | | | 150 | ℃ |
| $T_{JOP}$ | Maximum Operating Junction Temperature Range | | -40 | | +150 | ℃ |
| $T_{stg}$ | Storage Temperature | | -40 | | +125 | ℃ |
| CTI | Comparative Tracking Index | | 200 | | | |
| $R_{\theta CS}$ | Case-To-Sink Thermally (Conductive Grease Applied) | | | 0.1 | | ℃/W |
| T | Power Terminals Screw:M6 | | 3.0 | | 5.0 | N·m |
| T | Mounting Screw:M5 | | 3.0 | | 5.0 | N·m |
| G | Weight | | | 200 | | g |

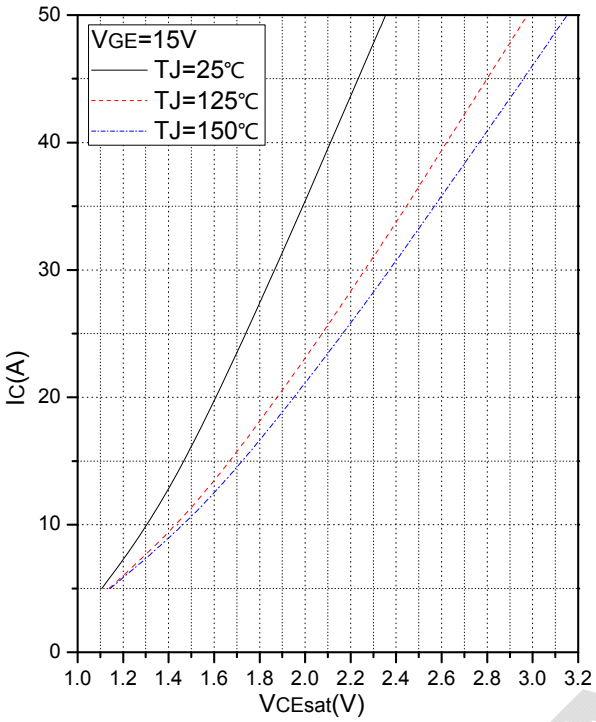



Fig.1 Typical Saturation Voltage Characteristics

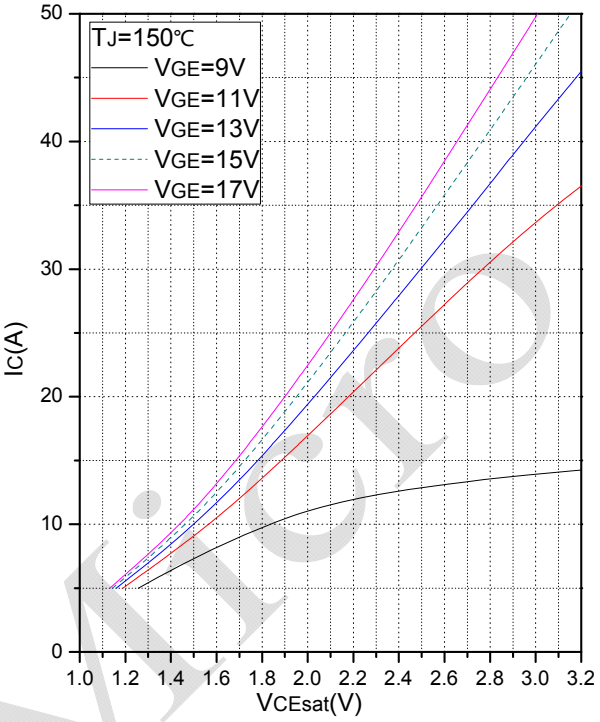



Fig.2 Typical Output Characteristics

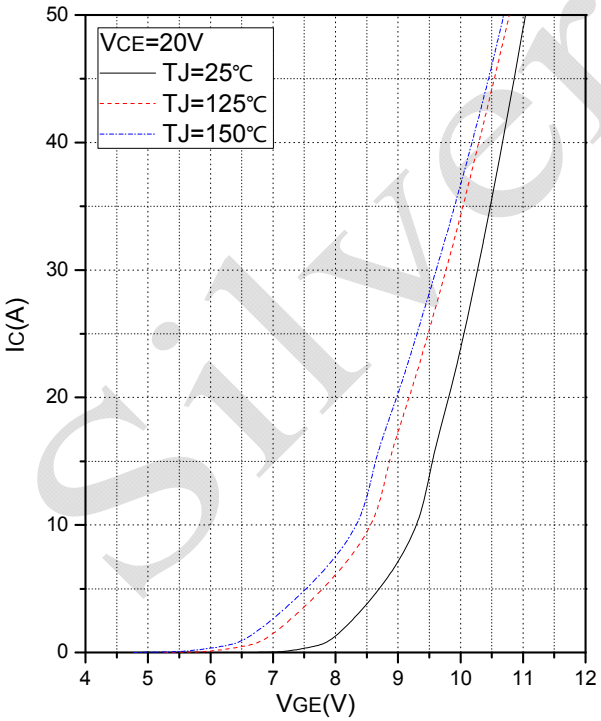



Fig.3Transfer Characteristic

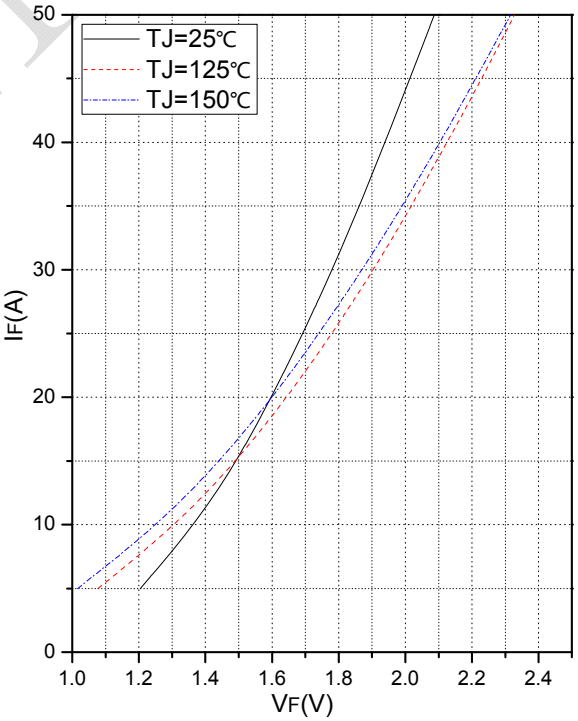



Fig.4 Forward Characteristics of FWD

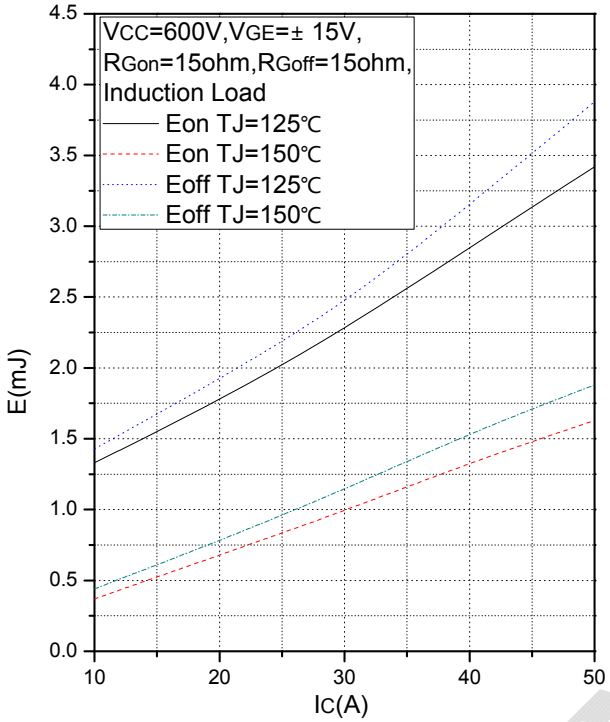



Fig.5 Typical Switching Loss vs. Collector Current

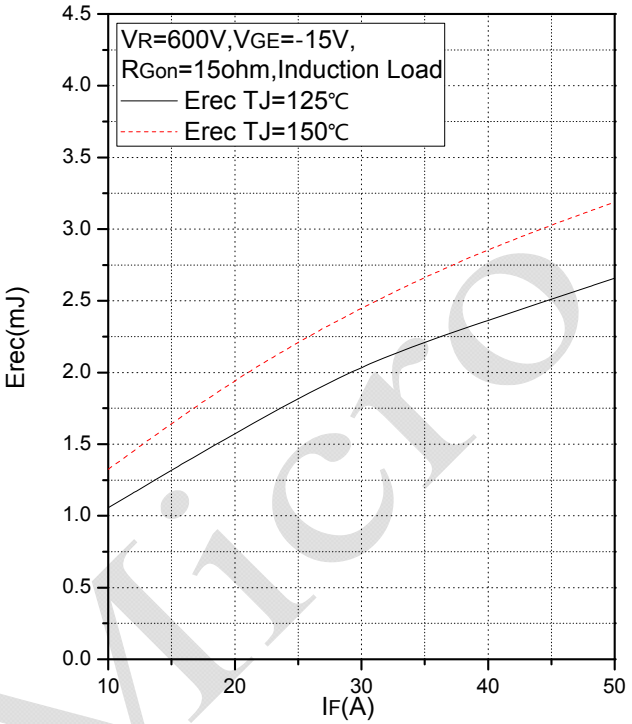



Fig.6 Typical Switching Loss vs. Forward Current

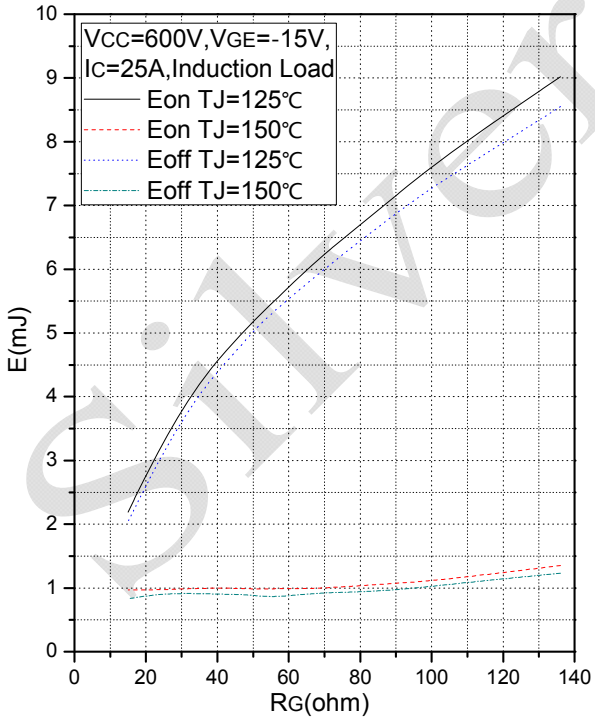



Fig.7 Typical Switching Loss vs. Gate Resistance

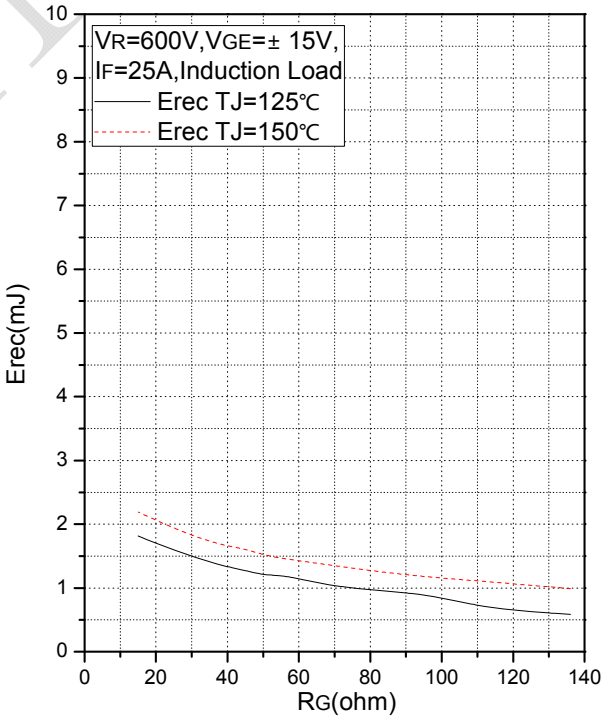



Fig.8 Typical Switching Loss vs. Gate Resistance

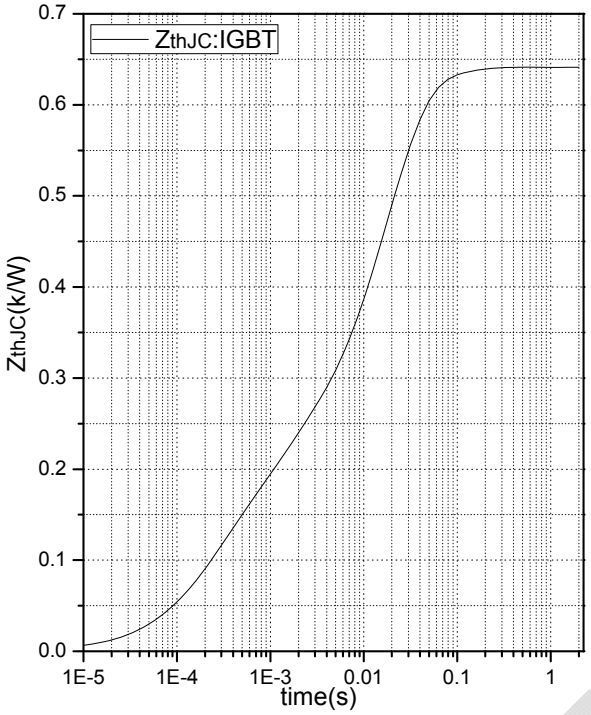



Fig.9 Transient Thermal Impedance (IGBT)

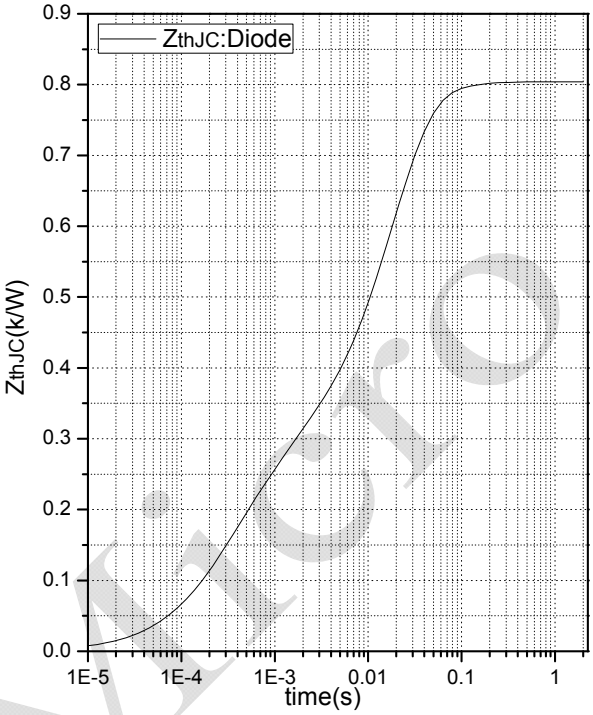



Fig.10 Transient Thermal Impedance (Diode)

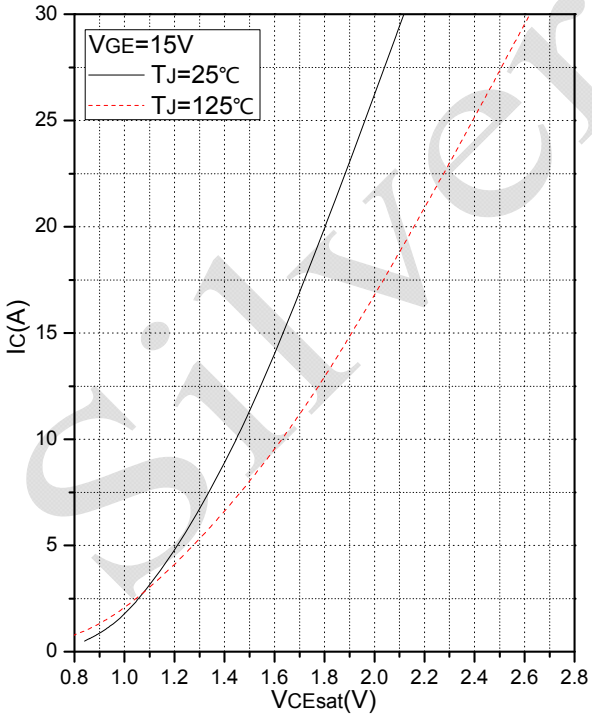



Fig.11Typical Saturation Voltage Characteristics (Brake-Chopper)

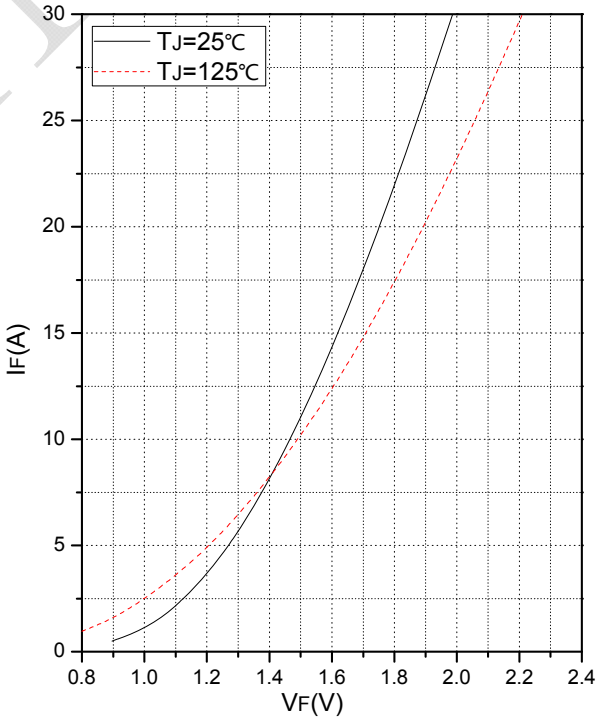



Fig.12 Forward Characteristics of Diode (Brake-Chopper)

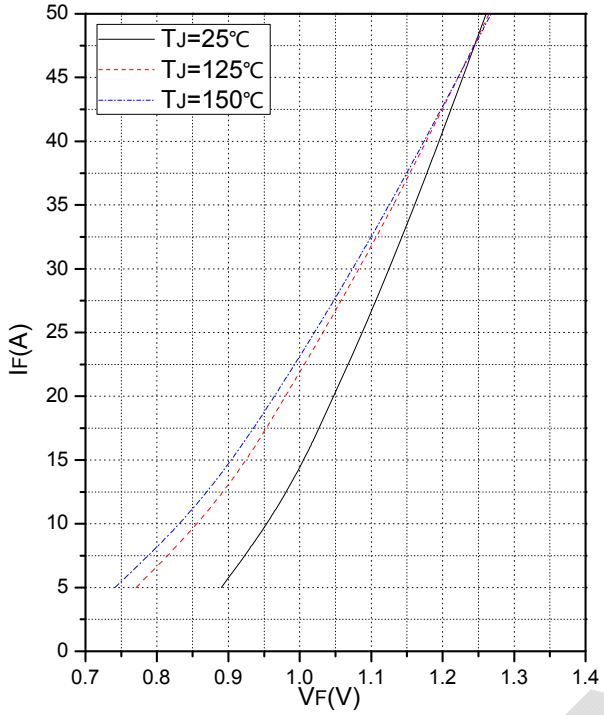



Fig.13 Forward Characteristics of Diode (Rectifier)

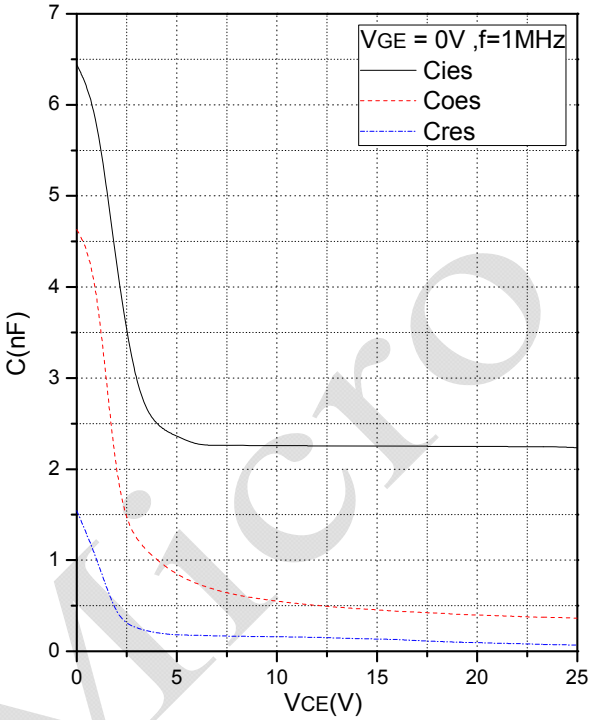



Fig.14 Capacitance Characteristics

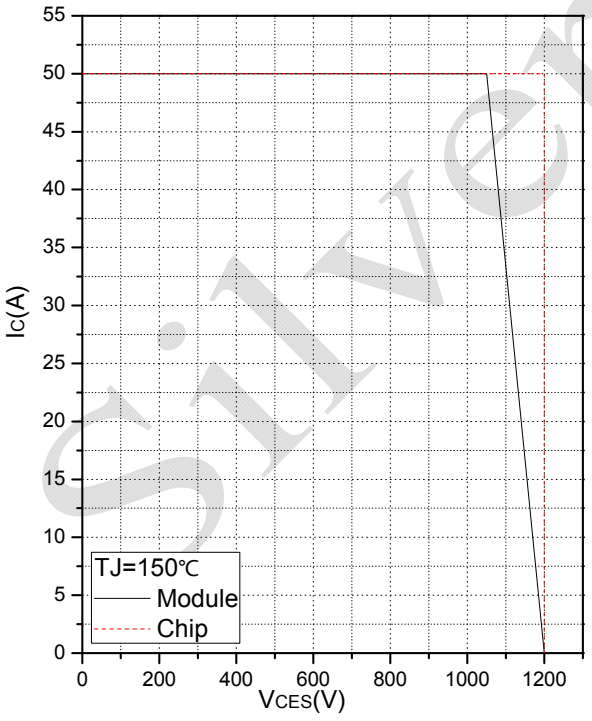



Fig.15 Reverse Bias Safe Operation Area (RBSOA)

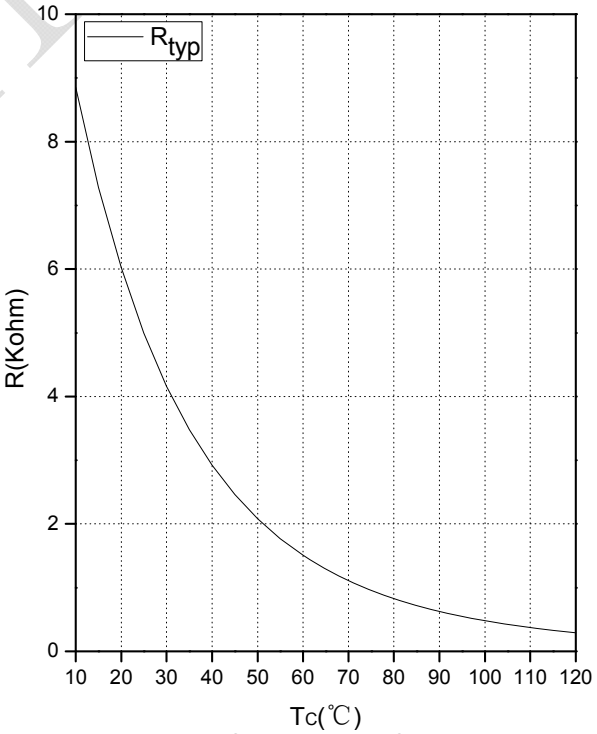
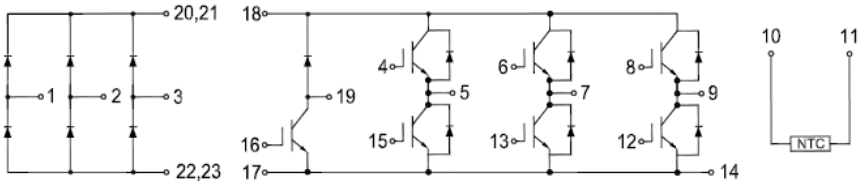
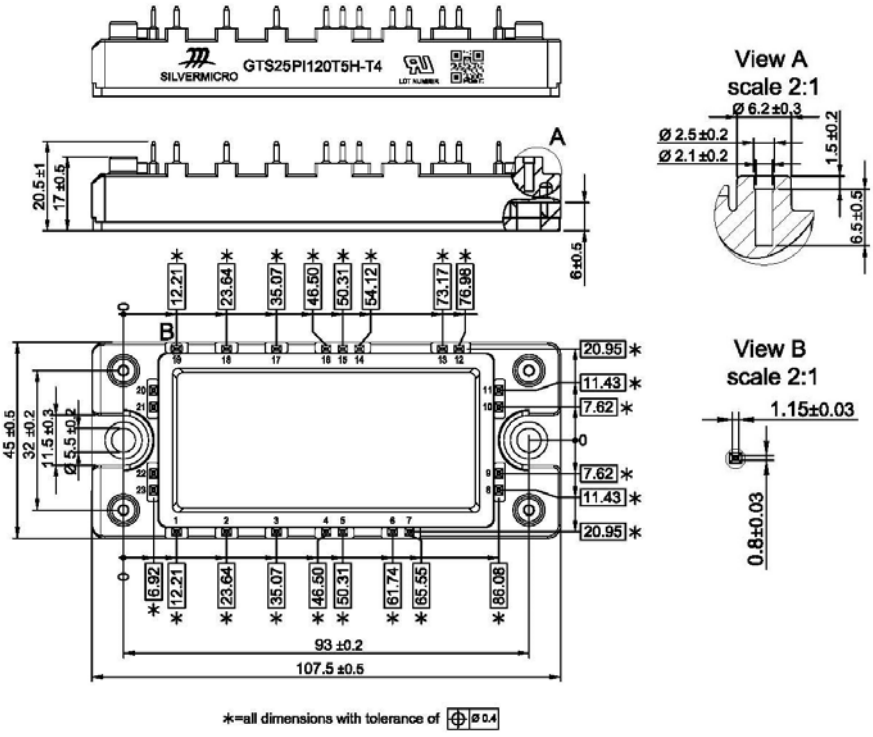



Fig.16 NTC Temperature Characteristics

## Internal Circuit




## Package Outline (Unit: mm):



| Date | Revision | Notes |
|---|---|---|
| 06/13/2019 | A | Final Version |
| | | |

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