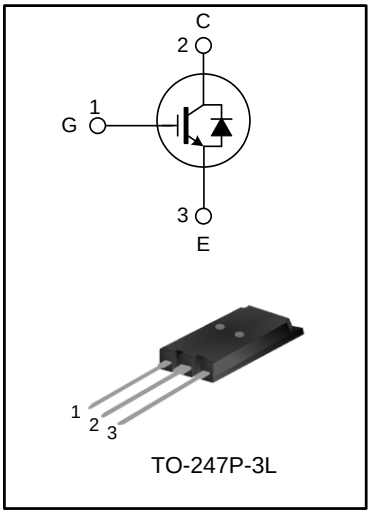
# 200A, 750V FIELD STOP IGBT

## DESCRIPTION

The SGTQ200V75SDB1PW field stop IGBT adopts Silan Field Stop 5 technology. It features low conduction loss and switching loss, is applicable to Motor Drives, DC/AC converter.




## FEATURES

- $V_{CE(sat)}$=1.40V$_{(典型值)}$@$I_C$=200A
- $T_{jmax}$=175°C
- Positive temperature coefficient
- Optimized parameter consistence
- High input impedance

## NOMENCLATURE

SGTQ 200 V 75 S D B 1 PW

IGBT series
Automotive

Current,
70: 70A

N : N-channel
NE : N-channel planner gate with ESD
T : Field Stop 3/4
U : Field Stop 4+
V : Field Stop 5
W: Field Stop 6
X : Field Stop 7

Voltage,
65: 650V
120: 1200V

Package
PW: TO-247P-3L

1,2,3⋯ : Version No.

Blank: Standard diode
M : Standard diode, full range
R : Rapid diode
B : Rapid diode, full range
S : Ultra soft diode, full range

D : packaged with fast recovery diode
R : RC IGBT

L : Ultra low switching，recommended frequency ~2KHz
Q : Low switching，recommended frequency2~20KHz
S : Standard frequency ，recommended frequency5~40KHz
F : Fast switching，recommended frequency10~60KHz
UF : Ultra fast switching，recommended frequency 40KHz~

## ORDERING INFORMATION

| Part No. | Package | Marking | Hazardous Substance Control | Packing Type |
|---|---|---|---|---|
| SGTQ200V75SDB1PW | TO-247P-3L | Q200V75SDB1 | Halogen free | Tube |

## ABSOLUTE MAXIMUM RATINGS (UNLESS OTHERWISE NOTED, $T_C$=25°C)

| Characteristics | | Symbol | Ratings | Unit |
|---|---|---|---|---|
| Collector to Emitter Voltage | | $V_{CE}$ | 750 | V |
| Gate to Emitter Voltage | | $V_{GE}$ | ±20 | V |
| Transient Gate-Emitter Voltage ($t_p$≤10μs, D<0.010) | | $V_{GE}$ | ±30 | V |
| Collector Current | $T_C$=25°C | $I_C$ | 400 | A |
| | $T_C$=100°C | | 200 | |
| Pulsed Collector Current | | $I_{CM}$ | 600 | A |
| Diode current | $T_C$=25°C | $I_F$ | 400 | A |
| | $T_C$=100°C | | 200 | |
| Diode Pulse Current | | $I_{FM}$ | 600 | A |
| Power Dissipation ($T_C$=25°C) | | $P_D$ | 1000 | W |
| Operating Junction Temperature | | $T_J$ | -55～+175 | °C |
| Storage Temperature Range | | $T_{stg}$ | -55～+175 | °C |

## THERMAL CHARACTERISTICS

| Characteristics | Symbol | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Thermal Resistance, Junction to Case (IGBT) | $R_{\theta JC}$ | -- | -- | -- | 0.15 | °C/W |
| Thermal Resistance, Junction to Case (FRD) | $R_{\theta JC}$ | -- | -- | -- | 0.26 | °C/W |
| Thermal Resistance, Junction to Ambient (IGBT) | $R_{\theta JA}$ | -- | -- | -- | 40 | °C/W |
| Soldering Temperature (in line) | $T_{sold}$ | $15^{+2}_{-0}$ sec, 1time | -- | -- | 260 | °C |

## ELECTRICAL CHARACTERISTICS OF IGBT (UNLESS OTHERWISE NOTED, $T_C$=25°C)

| Characteristics | Symbol | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Collector to Emitter Breakdown Voltage | $BV_{CE}$ | $V_{GE}$=0V, $I_C$=1mA | 750 | -- | -- | V |
| C-E Leakage Current | $I_{CES}$ | $V_{CE}$=750V, $V_{GE}$=0V | -- | -- | 50 | μA |
| G-E Leakage Current | $I_{GES}$ | $V_{GE}$=20V, $V_{CE}$=0V | -- | -- | ±100 | nA |
| G-E Threshold Voltage | $V_{GE(th)}$ | $I_C$=250μA, $V_{CE}$=$V_{GE}$ | 4.0 | 5.4 | 6.8 | V |
| Collector to Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_C$=200A, $V_{GE}$=15V, $T_C$=25°C | -- | 1.40 | 1.60 | V |
| | | $I_C$=200A, $V_{GE}$=15V, $T_C$=150°C | -- | 1.55 | -- | V |
| | | $I_C$=200A, $V_{GE}$=15V, $T_C$=175°C | -- | 1.58 | -- | V |
| Input Capacitance | $C_{ies}$ | $V_{CE}$=30V<br>$V_{GE}$=0V<br>f=1MHz | -- | 21370 | -- | pF |
| Output Capacitance | $C_{oes}$ | | -- | 498 | -- | |
| Reverse Transfer Capacitance | $C_{res}$ | | -- | 94 | -- | |
| Turn-On Delay Time | $T_{d(on)}$ | $V_{CE}$=400V<br>$I_C$=200A<br>$R_g$=10Ω<br>$V_{GE}$=15V<br>inductive load<br>$T_C$=25°C | -- | 135 | -- | ns |
| Rise Time | $T_r$ | | -- | 112 | -- | |
| Turn-Off Delay Time | $T_{d(off)}$ | | -- | 534 | -- | |
| Fall Time | $T_f$ | | -- | 65 | -- | |
| Turn-On Switching Loss | $E_{on}$ | | -- | 13.0 | -- | mJ |
| Turn-Off Switching Loss | $E_{off}$ | | -- | 7.5 | -- | |
| Total Switching Loss | $E_{st}$ | | -- | 20.5 | -- | |
| Total Gate Charge | $Q_g$ | $V_{CE}$=400V, $I_C$=100A, $V_{GE}$=15V | -- | 750 | -- | nC |
| Gate to Emitter Charge | $Q_{ge}$ | | -- | 178 | -- | |
| Gate to Collector Charge | $Q_{gc}$ | | -- | 257 | -- | |

## ELECTRICAL CHARACTERISTICS OF FRD ($T_C$=25°C, UNLESS OTHERWISE NOTED)

| Parameter | Symbol | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Diode Forward Voltage | $V_{FM}$ | $I_F$=200A, $T_C$=25°C | -- | 1.80 | 2.20 | V |
| | | $I_F$=200A, $T_C$=150°C | -- | 1.81 | -- | |
| | | $I_F$=200A, $T_C$=175°C | | 1.82 | -- | |
| Diode Reverse Recovery Time | $T_{rr}$ | $I_{ES}$=200A, $dI_{ES}/dt$=200A/μs,<br>$T_C$=25°C | -- | 212 | -- | ns |
| Diode Reverse Recovery Charge | $Q_{rr}$ | | -- | 8.1 | -- | μC |
| Diode Reverse Recovery Current | Irrm | | -- | 11 | -- | A |

## ELECTRICAL CHARACTERISTICS OF IGBT ($T_C$=175°C)

| Parameter | Symbol | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Turn-On Delay Time | $T_{d(on)}$ | $V_{CE}$=400V<br>$I_C$=200A<br>$R_g$=10Ω<br>$V_{GE}$=15V<br>inductive load<br>$T_C$=175°C | -- | 130 | -- | ns |
| Rise Time | $T_r$ | | -- | 121 | -- | |
| Turn-Off Delay Time | $T_{d(off)}$ | | -- | 605 | -- | |
| Fall Time | $T_f$ | | -- | 96 | -- | |
| Turn-On Switching Loss | $E_{on}$ | | -- | 17.5 | -- | mJ |
| Turn-Off Switching Loss | $E_{off}$ | | -- | 10.2 | -- | |
| Total Switching Loss | $E_{st}$ | | -- | 27.7 | -- | |

## ELECTRICAL CHARACTERISTICS OF FRD ($T_C$=175°C)

| Parameter | Symbol | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Diode Reverse Recovery Time | $T_{rr}$ | $I_{ES}$=200A, $dI_{ES}/dt$=200A/μs,<br>$T_C$=175°C | -- | 500 | -- | ns |
| Diode Reverse Recovery Charge | $Q_{rr}$ | | -- | 18 | -- | μC |
| Diode Reverse Recovery Current | Irrm | | -- | 19 | -- | A |

## TYPICAL CHARACTERISTICS

Figure 1. Typical Output Characteristics

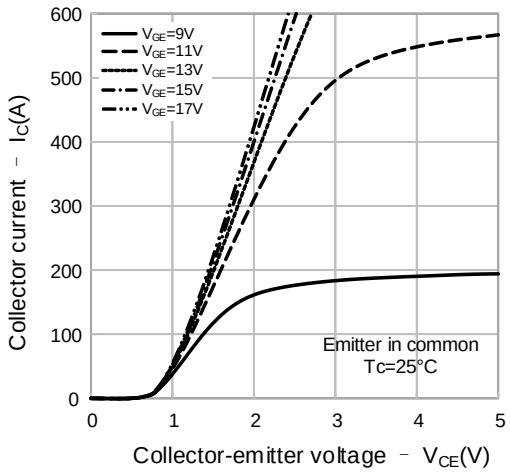



Figure 2. Typical Output Characteristics

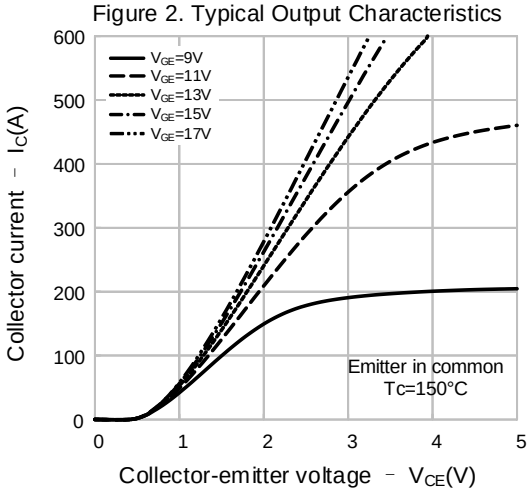



Figure 3. Typical Saturation Voltage Characteristics

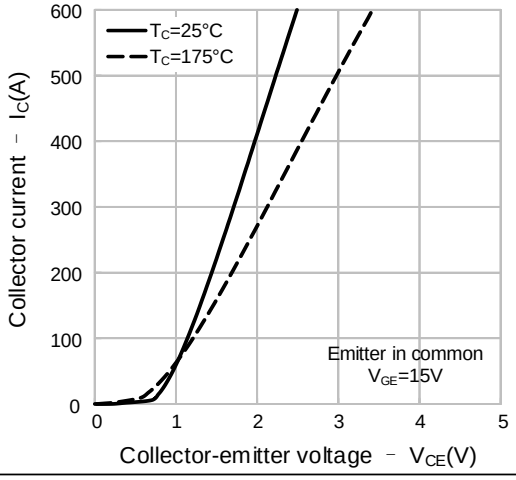



Figure 4. Transmission Characteristics

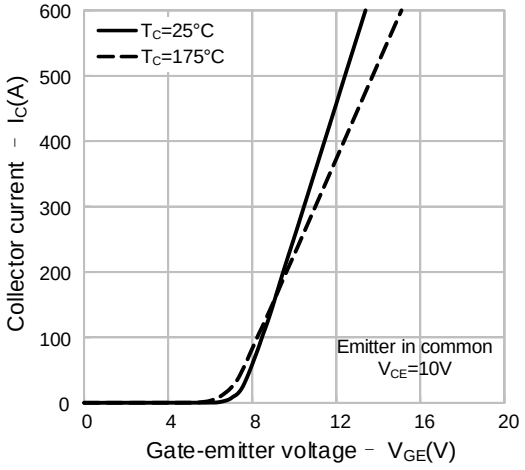



Figure 5. Saturation Voltage Drop vs. $V_{GE}$

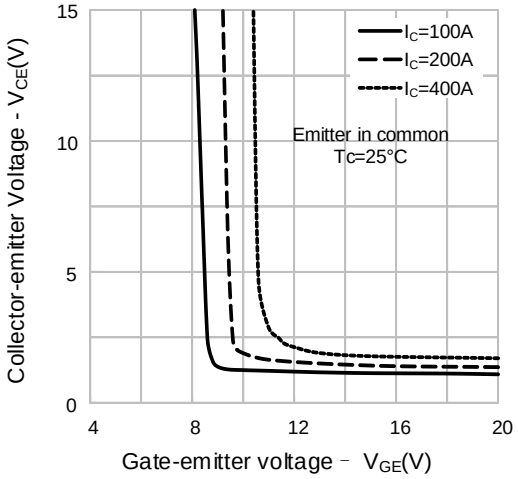
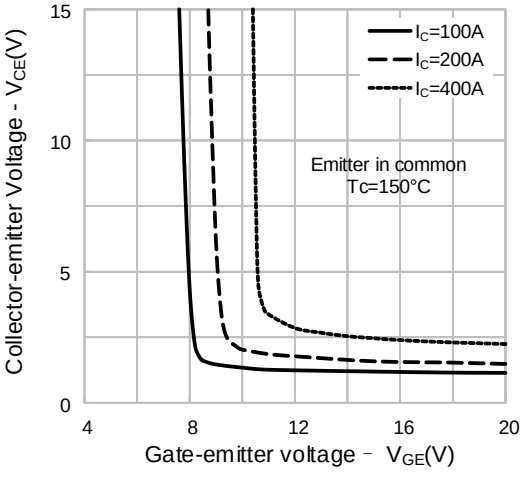



Figure 6. Saturation voltage vs. $V_{GE}$



## TYPICAL CHARACTERISTICS (CONTINUED)

Figure 7. Saturation Voltage vs. Temperature

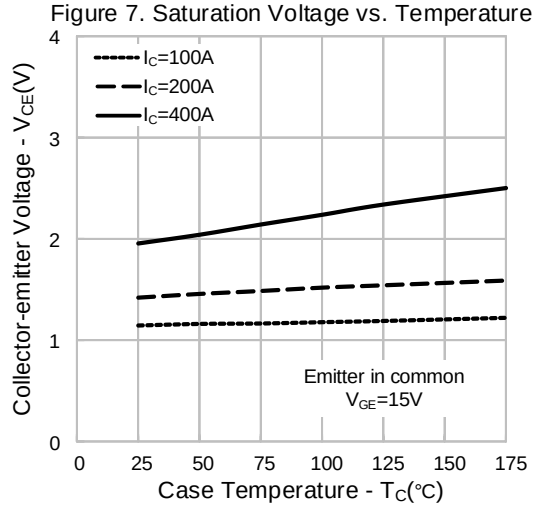



Figure 8. Capacitance Characteristics

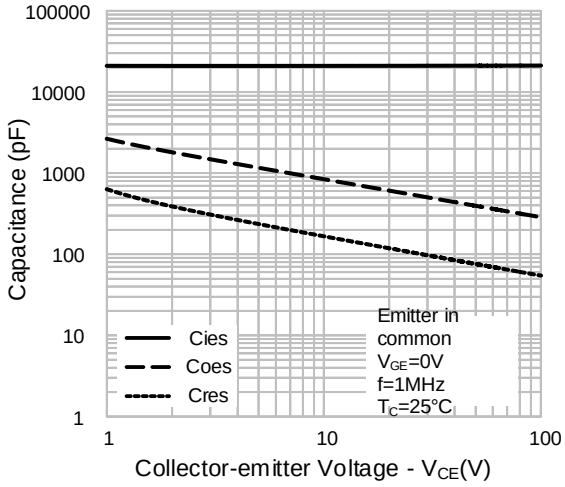



Figure 9. Gate Charge Characteristics

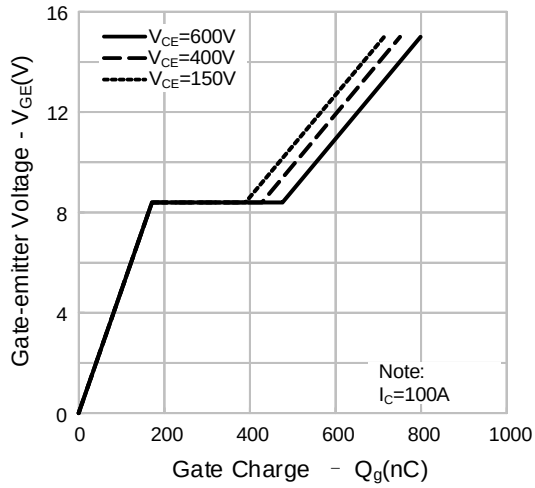



Figure 10. Forward Characteristics

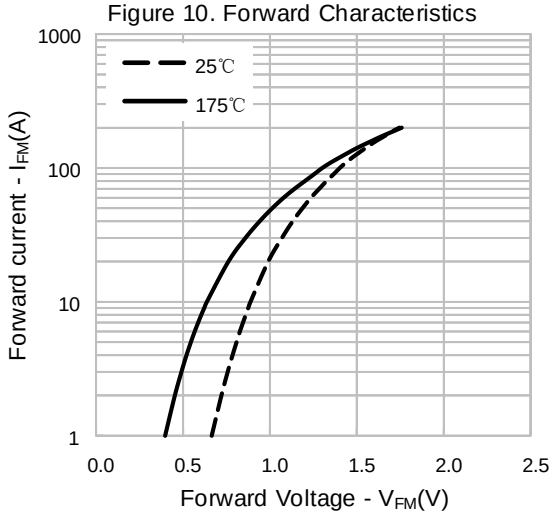



Figure 11. Turn-on Characteristics vs. Gate Resistance

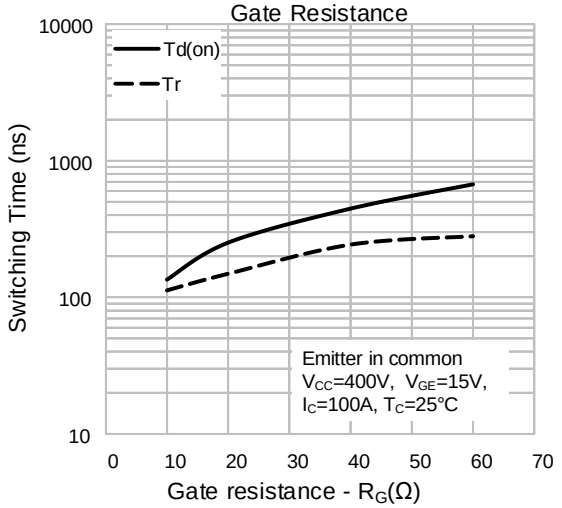
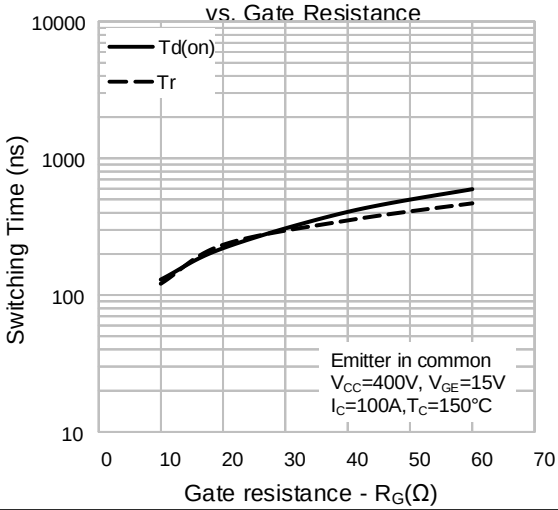



Figure 12. Turn-on Characteristics vs. Gate Resistance



## TYPICAL CHARACTERISTICS (CONTINUED)

Figure 13. Turn-off Characteristics vs. Gate Resistance

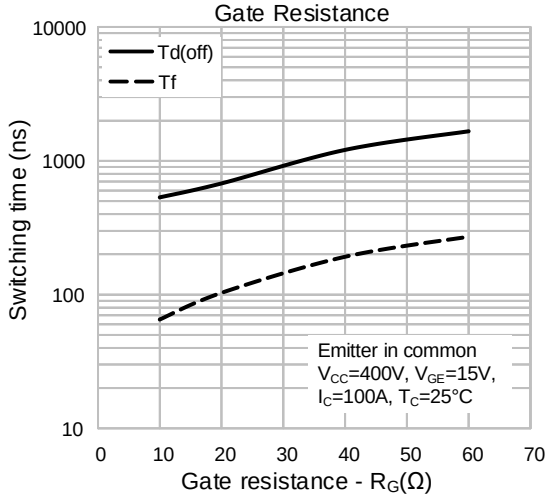



Figure 14. Turn-off Characteristics vs. Gate Resistance

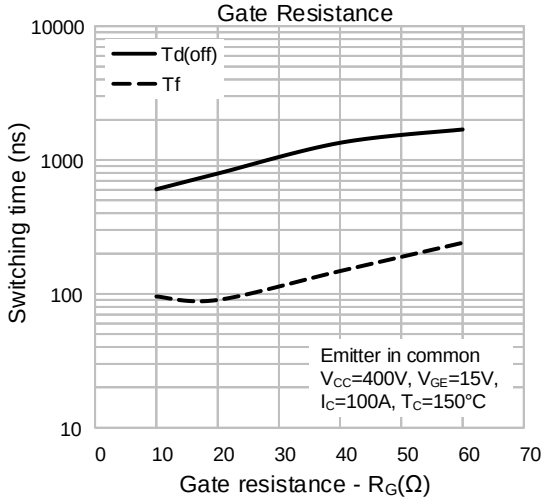



Figure 15. Switching Loss vs. Gate Resistance

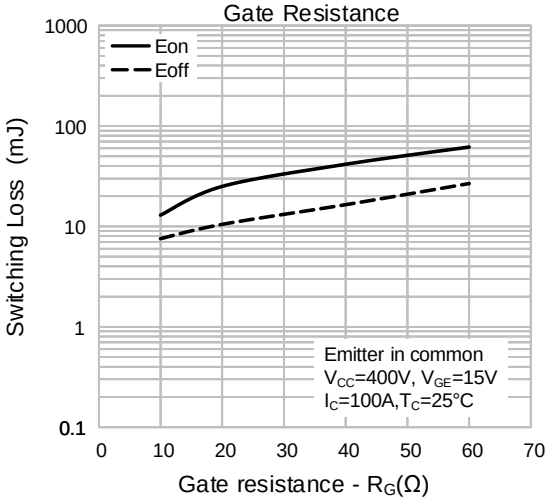



Figure 16. Switching Loss vs. Gate Resistance

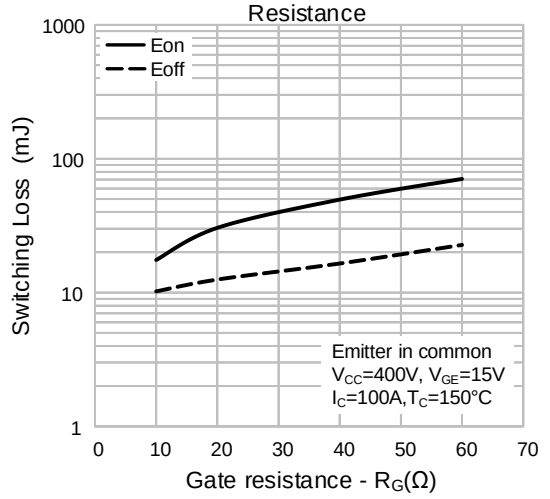



Figure 17. Conduction Characteristics vs. Collector Current

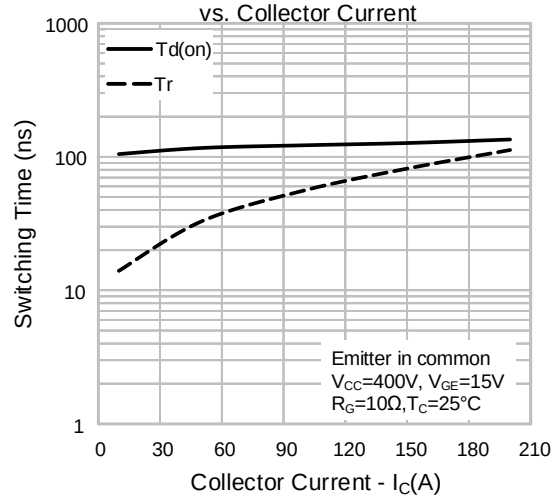
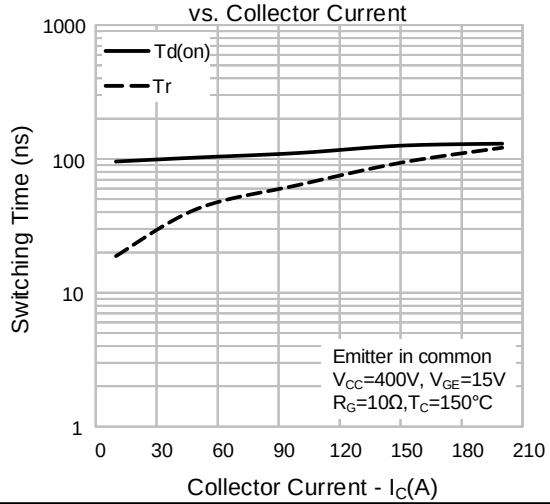



Figure 18. Conduction Characteristics vs. Collector Current



## TYPICAL CHARACTERISTICS (CONTINUED)

Figure 19. Turn-off Characteristics vs. Collector Current

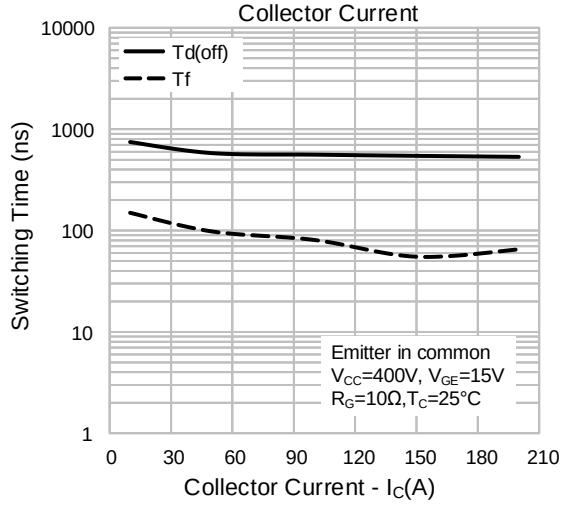



Figure 20. Turn-off Characteristics vs. Collector Current

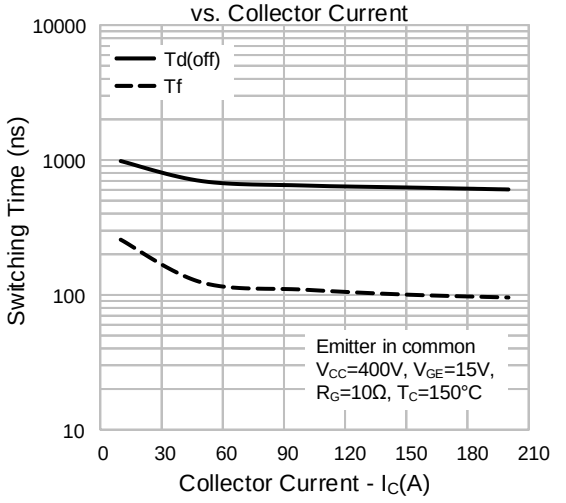



Figure 21. Switching Loss vs. Collector Current

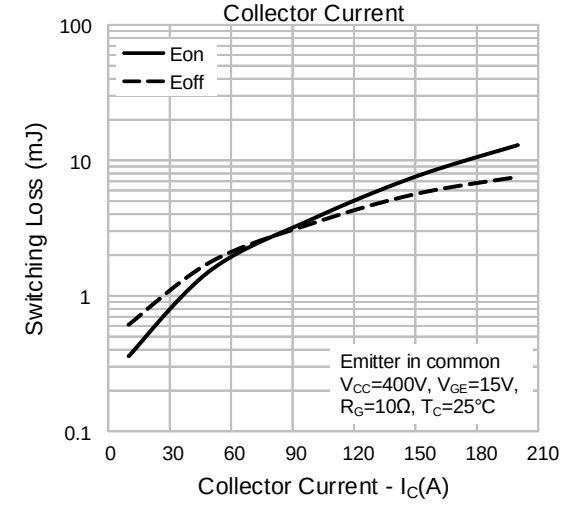



Figure 22. Switching Loss vs. Collector Current

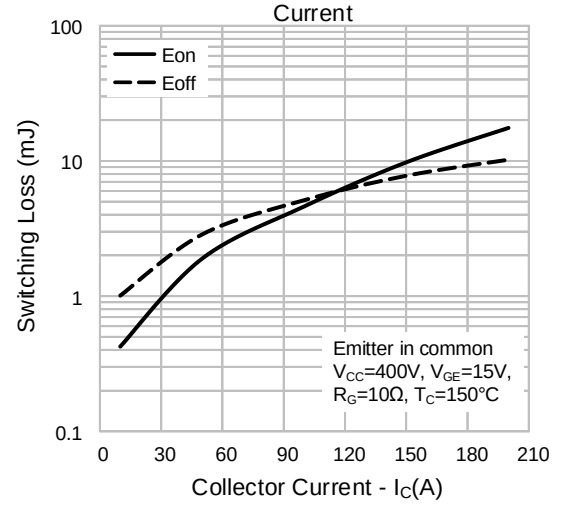



Figure 23. Reverse Recovery Time vs. Forward Current

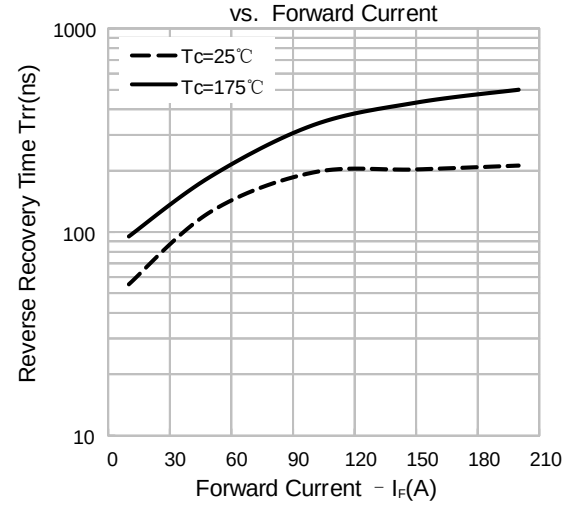
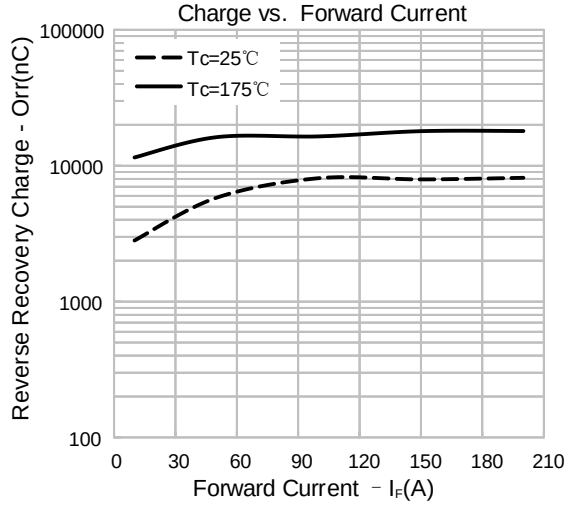



Figure 24. Reverse Recovery Charge vs. Forward Current



## TYPICAL CHARACTERISTICS (CONTINUED)

Figure 25. Peak Reverse Recovery Current vs. Forward Current

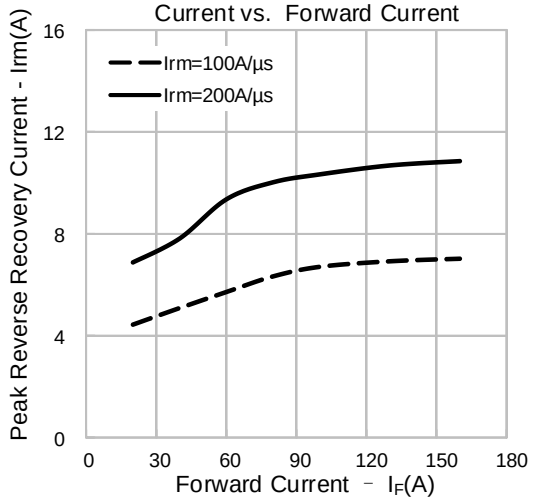



Figure 26. Tb Slope vs. Forward Current

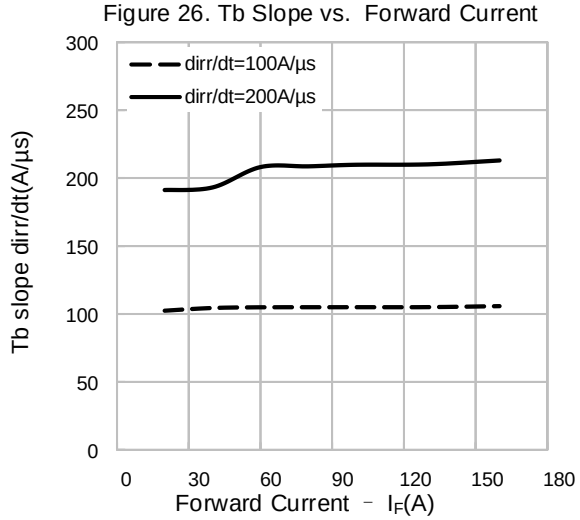



Figure 27. Max. Safe Operating Area

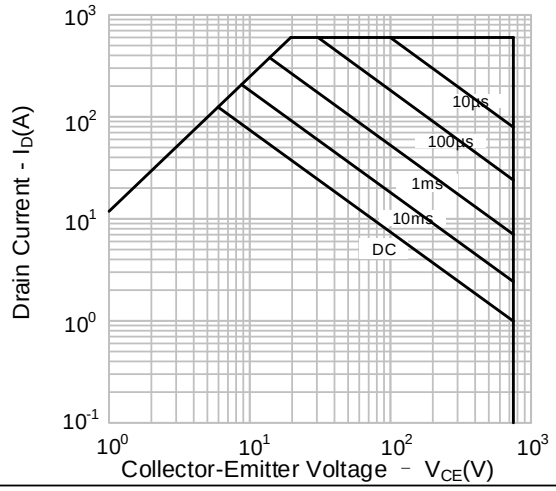



Figure 28. Transient Thermal Impedance vs. On-pulse Duration(IGBT)

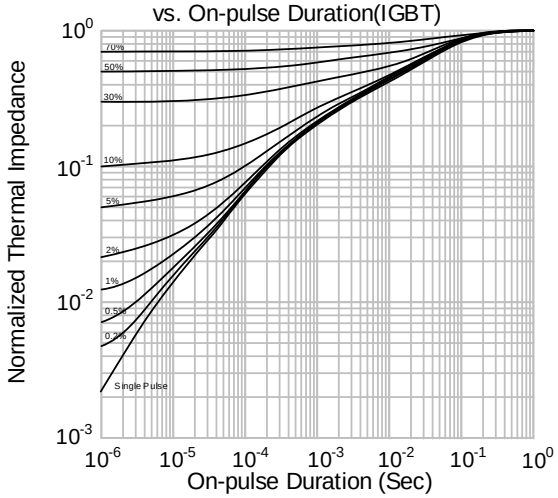
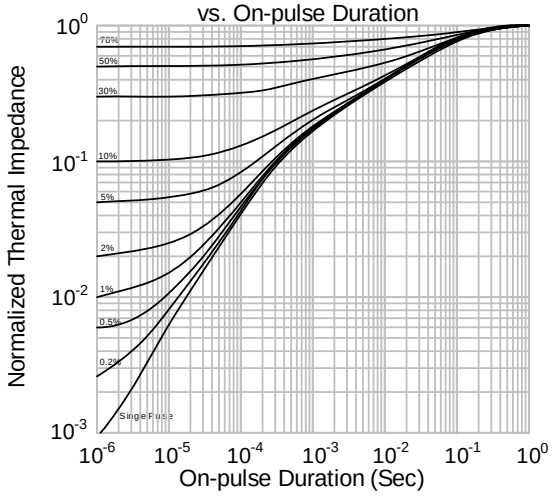
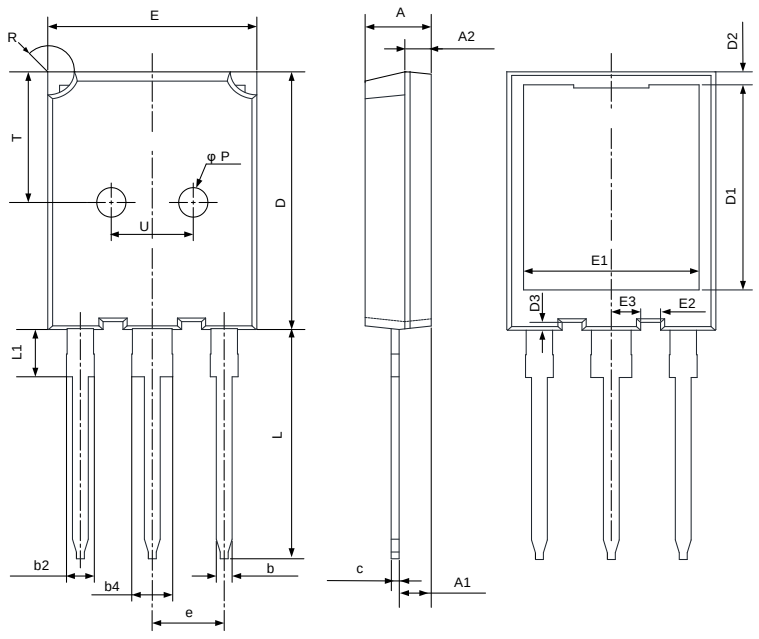



Figure 29. Diode Transient Thermal Impedance vs. On-pulse Duration



## PACKAGE OUTLINE

**TO-247P-3L** **UNIT: mm**




| SYMBOL | MILLIMETER | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 4.90 | 5.00 | 5.10 |
| A1 | 2.31 | 2.41 | 2.51 |
| A2 | 1.90 | 2.00 | 2.10 |
| b | 1.16 | — | 1.26 |
| b2 | — | — | 2.25 |
| b4 | — | — | 3.25 |
| c | 0.59 | — | 0.66 |
| D | 20.90 | 21.00 | 21.10 |
| D1 | 16.25 | 16.55 | 16.85 |
| D2 | 1.05 | 1.17 | 1.35 |
| D3 | 0.58 | — | 0.78 |
| e | 5.436 BSC | | |
| E | 15.70 | 15.80 | 15.90 |
| E1 | 13.10 | 13.30 | 13.50 |
| E2 | 1.40 | 1.50 | 1.60 |
| E3 | 2.12 | 2.22 | 2.32 |
| L | 19.80 | 19.95 | 20.10 |
| L1 | — | — | 4.30 |
| T | 9.80 | — | 10.20 |
| P | 2.40 | 2.50 | 2.60 |
| U | 6.00 | — | 6.40 |
| R | 1.90 | — | 2.10 |


**MOS DEVICES OPERATE NOTES:**

Electrostatic charges may exist in many things. Please take following preventive measures to prevent effectively the MOS electric circuit as a result of the damage which is caused by discharge:

- The operator must put on wrist strap which should be earthed to against electrostatic.
- Equipment cases should be earthed.
- All tools used during assembly, including soldering tools and solder baths, must be earthed.
- MOS devices should be packed in antistatic/conductive containers for transportation.

**Important notice:**

1. Silan reserves the right to make changes of this instruction without notice.
2. Customers should obtain the latest relevant information when purchasing and should verify whether such information is latest and complete. Please read this instruction and application manual and related materials carefully before using products, including the circuit operation precautions, etc.
3. Silan does not give any warranties as to the suitability of the Silan's product for any specific use. The design intent, design definition and design of the product are not intended for application (the application stated in this instruction includes use, etc.) in medical equipment, life-saving equipment, aerospace equipment, non-civil equipment or non-civil use, etc. (the equipment stated in this instruction includes systems, devices, etc., all referred to as equipment),.The product should not be used in any equipment or system whose manufacture, use or sale is prohibited under any applicable laws or regulations ("unintended use"). If the product is used for unintended use, therefore the full risks of such products application are borne by the customer and Silan assumes no liability for the product used for the unintended use. If the customer intends to use the Silan's product in a application where malfunction or failure can be reasonably be expected to result in personal injury, or serious property, or environment damage, the customer shall make adequate assessment, testing and verification, and Silan shall not be liable for such applications.
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Rev.: 1.2

Revision History:

1. Update electrical characteristics
2. Update typical characteristics
3. Update important notice

Rev.: 1.1

Revision History:

1. Modify features
2. Update package outline

Rev.: 1.0

Revision History:

1. First release