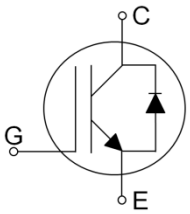
# TGL40N120ND
## NPT Trench IGBT

**Features:**
- 1200V NPT Trench Technology
- High Speed Switching
- Low Conduction Loss
- Positive Temperature Coefficient
- Easy parallel Operation
- RoHS compliant
- JEDEC Qualification


**Applications :**
Induction Heating, general purpose inverter application

| Device | Package | Marking | Remark |
|---|---|---|---|
| TGL40N120ND | TO-264 | TGL40N120ND | RoHS |

## Absolute Maximum Ratings

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Collector-Emitter Voltage | | $V_{CES}$ | 1200 | V |
| Gate-Emitter Voltage | | $V_{GES}$ | ±20 | V |
| Continuous Collector Current | $T_C$ = 25 ℃ | $I_c$ | 80 | A |
| | $T_C$ = 100 ℃ | | 40 | A |
| Pulsed Collector Current (Note 1) | | $I_{CM}$ | 120 | A |
| Diode Continuous Forward Current | $T_C$ = 100 ℃ | $I_F$ | 40 | A |
| Diode Maximum Forward Current | | $I_{FM}$ | 120 | A |
| Power Dissipation | $T_C$ = 25 ℃ | $P_D$ | 455 | W |
| | $T_C$ = 100 ℃ | | 182 | W |
| Operating Junction Temperature | | $T_J$ | -55 ~ 150 | ℃ |
| Storage Temperature Range | | $T_{STG}$ | -55 ~ 150 | ℃ |
| Maximum lead temperature for soldering purposes, 1/8” from case for 5 seconds | | $T_L$ | 300 | ℃ |

Notes :
(1) Repetitive rating : Pulse width limited by maximum junction temperature

## Thermal Characteristics

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Thermal resistance, Junction-to-Case | $R_{\theta JC}$ (IGBT) | 0.275 | ℃/W |
| Maximum Thermal resistance, Junction-to-Case | $R_{\theta JC}$ (DIODE) | 0.95 | ℃/W |
| Maximum Thermal resistance, Junction-to-Ambient | $R_{\theta JA}$ | 25 | ℃/W |

## Electrical Characteristics of the IGBT $T_C$=25℃, unless otherwise noted

| Parameter | Symbol | Test condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **OFF** | | | | | | |
| Collector – Emitter Breakdown Voltage | $BV_{CES}$ | $V_{GE}$ = 0V, $I_C$ = 1mA | 1200 | -- | -- | V |
| Zero Gate Voltage Collector Current | $I_{CES}$ | $V_{CE}$ = 1200V, $V_{GE}$ = 0V | -- | -- | 1 | mA |
| Gate – Emitter Leakage Current | $I_{GES}$ | $V_{CE}$ = 0V, $V_{GE}$ = ± 20V | -- | -- | ± 250 | nA |
| **ON** | | | | | | |
| Gate – Emitter Threshold Voltage | $V_{GE(TH)}$ | $V_{GE}$ = $V_{CE}$, $I_C$ = 40mA | 4.0 | 6.0 | 8.0 | V |
| Collector – Emitter Saturation Voltage | $V_{CE(SAT)}$ | $V_{GE}$ = 15V, $I_C$ = 40A, $T_C$ = 25 °C | -- | 2.0 | 2.8 | V |
| | | $V_{GE}$ = 15V, $I_C$ = 40A, $T_C$ = 125 °C | -- | 2.5 | -- | V |
| **DYNAMIC** | | | | | | |
| Input Capacitance | $C_{IES}$ | $V_{CE}$ = 30V, $V_{GE}$ = 0V f = 1MHz | -- | 5150 | -- | pF |
| Output Capacitance | $C_{OES}$ | | -- | 150 | -- | pF |
| Reverse Transfer Capacitance | $C_{RES}$ | | -- | 100 | -- | pF |
| **SWITCHING** (Note 2) | | | | | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{CC}$ = 600V, $I_C$ = 40A $R_G$ = 5Ω, $V_{GE}$ = 15V Inductive Load, $T_C$ = 25 °C | -- | 41 | -- | ns |
| Rise Time | $t_r$ | | -- | 82 | -- | ns |
| Turn-Off Delay Time | $t_{d(off)}$ | | -- | 200 | -- | ns |
| Fall Time | $t_f$ | | -- | 85 | 170 | ns |
| Turn-On Switching Loss | $E_{ON}$ | | -- | 5.8 | 8.7 | mJ |
| Turn-Off Switching Loss | $E_{OFF}$ | | -- | 1.5 | 2.3 | mJ |
| Total Switching Loss | $E_{TS}$ | | -- | 7.3 | 11 | mJ |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{CC}$ = 600V, $I_C$ = 40A $R_G$ = 5Ω, $V_{GE}$ = 15V Inductive Load, $T_C$ = 125 °C | -- | 45 | -- | ns |
| Rise Time | $t_r$ | | -- | 76 | -- | ns |
| Turn-Off Delay Time | $t_{d(off)}$ | | -- | 212 | -- | ns |
| Fall Time | $t_f$ | | -- | 189 | -- | ns |
| Turn-On Switching Loss | $E_{ON}$ | | -- | 5.6 | 8.4 | mJ |
| Turn-Off Switching Loss | $E_{OFF}$ | | -- | 3.3 | 5 | mJ |
| Total Switching Loss | $E_{TS}$ | | -- | 8.9 | 13.4 | mJ |
| Total Gate Charge | $Q_g$ | $V_{CC}$ = 600V, $I_C$ = 40A $V_{GE}$ = 15V | -- | 340 | 510 | nC |
| Gate-Emitter Charge | $Q_{ge}$ | | -- | 45 | 67 | nC |
| Gate-Collector Charge | $Q_{gc}$ | | -- | 155 | 230 | nC |
| Short Circuit Withstanding Time | $t_{SC}$ | $V_{CC}$ = 600V, $V_{GE}$ = 15V | 10 | -- | -- | µs |

Notes :
(2) Not subject to production test – verified by design/characterization

## Electrical Characteristics of the DIODE $T_C$=25℃, unless otherwise noted

| Parameter | Symbol | Test condition | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Diode Forward Voltage | $V_{FM}$ | $I_F$ = 40A | $T_C$ = 25 °C | -- | 2.8 | -- | V |
| | | | $T_C$ = 125 °C | -- | 2.9 | -- | |
| Reverse Recovery Time | $t_{rr}$ | $I_F$ = 40A, di/dt = 200A/μs | $T_C$ = 25 °C | -- | 220 | -- | ns |
| | | | $T_C$ = 125 °C | -- | 310 | -- | |
| Reverse Recovery Current | $I_{rr}$ | | $T_C$ = 25 °C | -- | 24 | -- | A |
| | | | $T_C$ = 125 °C | -- | 36 | -- | |
| Reverse Recovery Charge | $Q_{rr}$ | | $T_C$ = 25 °C | -- | 2600 | -- | nC |
| | | | $T_C$ = 125 °C | -- | 5580 | -- | |

# IGBT Characteristics

Fig. 1 Output characteristics

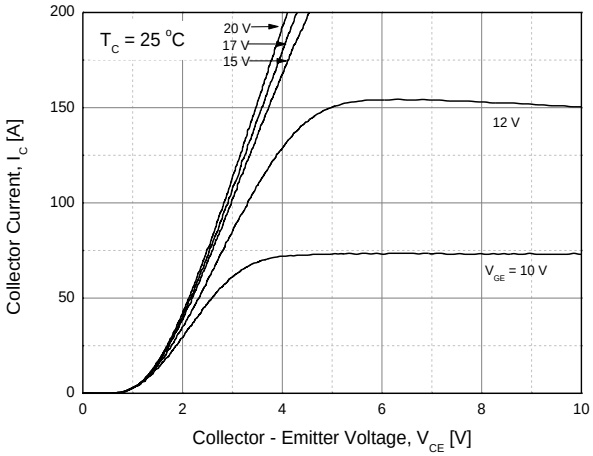



Fig. 2 Saturation voltage characteristics

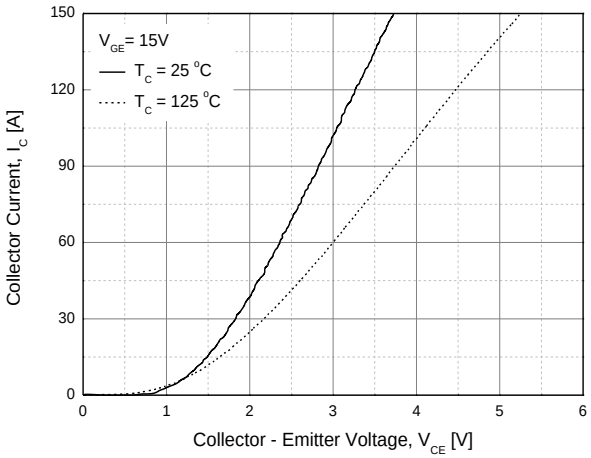



Fig. 3 Saturation voltage vs. collector current

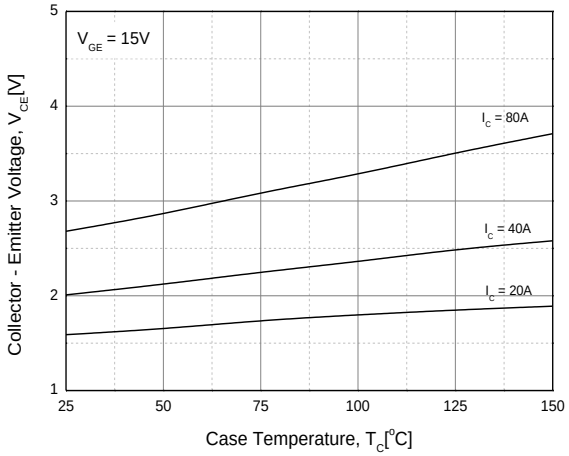



Fig. 4 Saturation voltage vs. gate bias

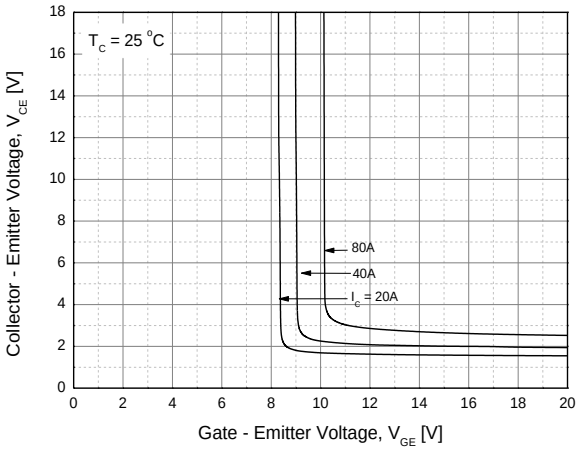



Fig. 5 Saturation voltage vs. gate bias

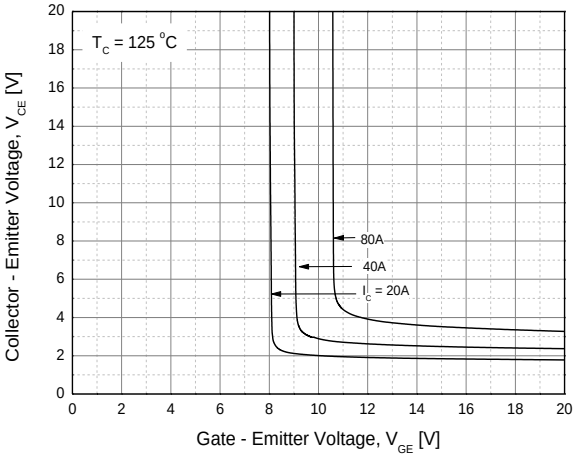
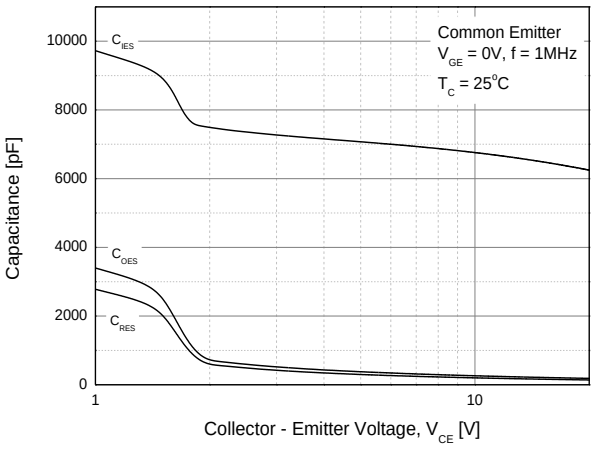



Fig. 6 Capacitance characteristics



# IGBT Characteristics

Fig. 7 Turn-on time vs. gate resistor

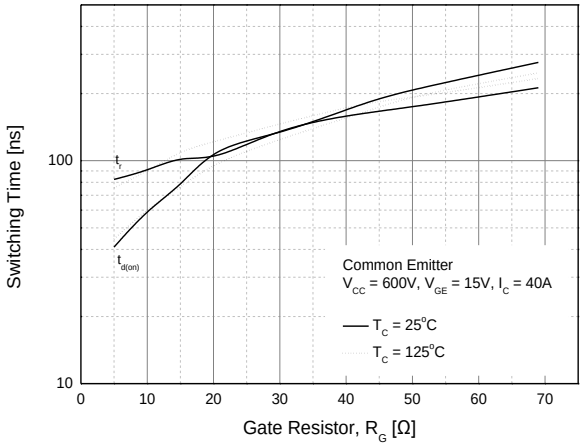



Fig. 8 Turn-off time vs. gate resistor

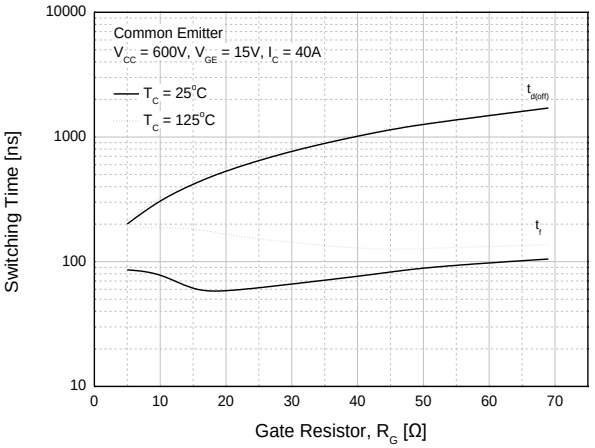



Fig. 9 Switching loss vs. gate resistor

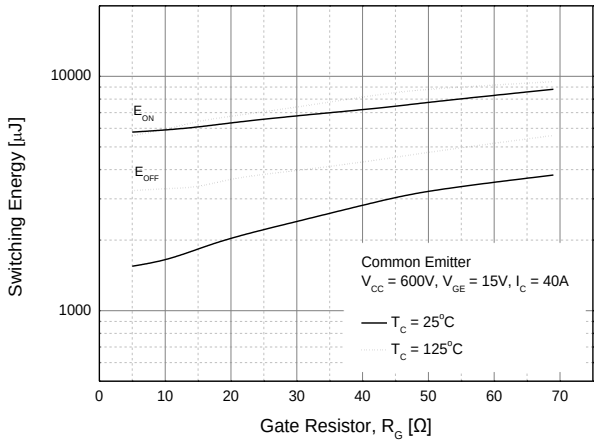



Fig. 10 Turn-on time vs. collector current

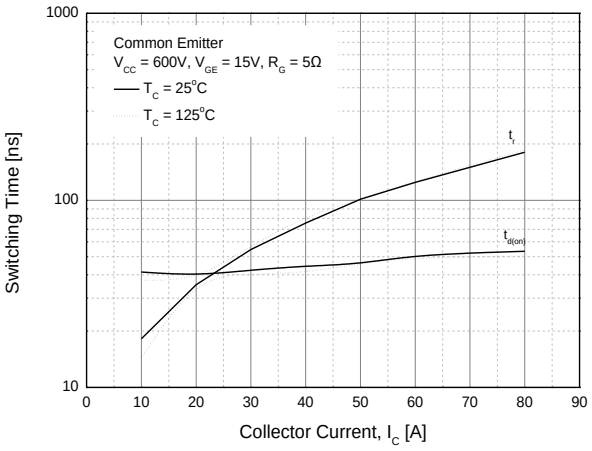



Fig. 11 Turn-off time vs. collector current

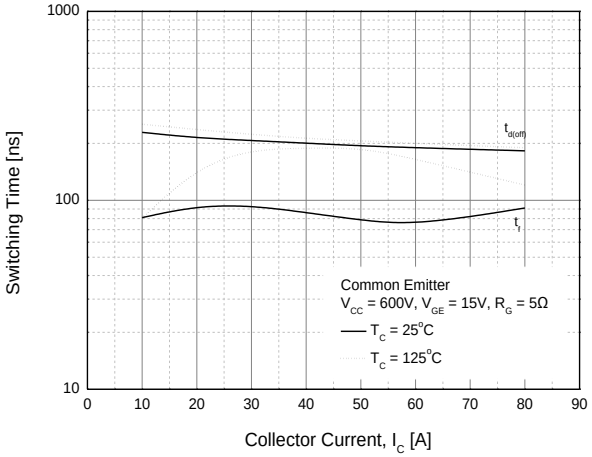
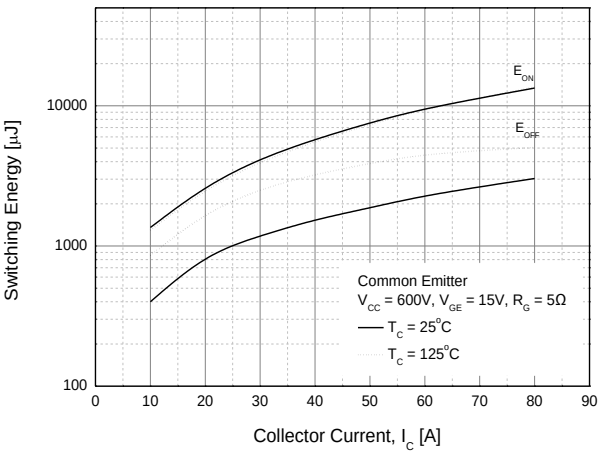



Fig. 12 Switching loss vs. collector current



# IGBT Characteristics

Fig. 13 Gate charge characteristics

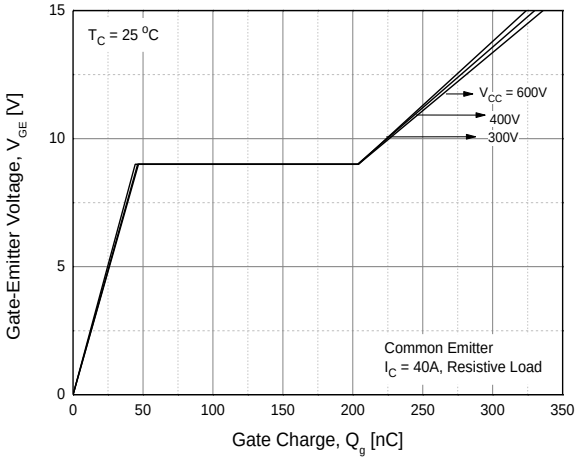



Fig. 14 SOA

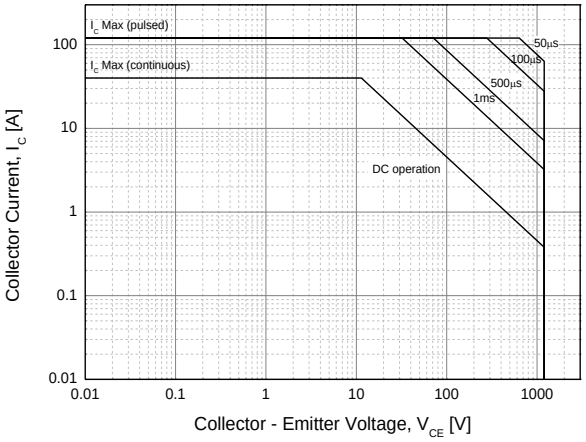



Fig. 15 RBSOA

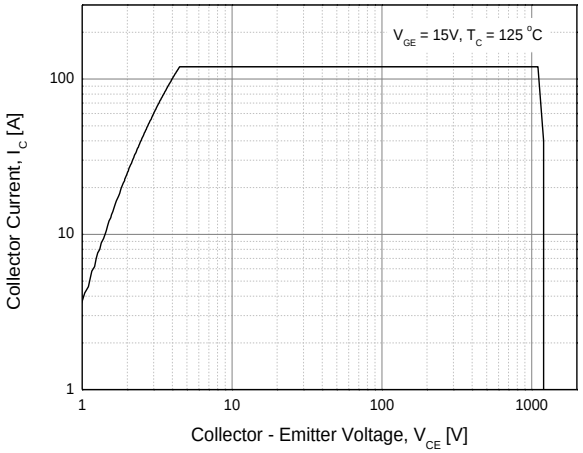



Fig. 16 Transient thermal impedance of IGBT

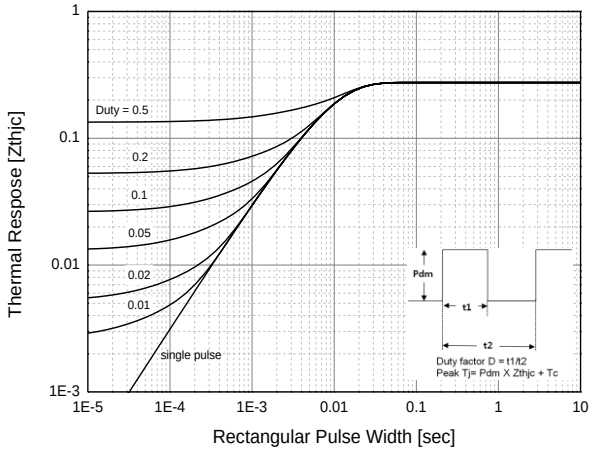
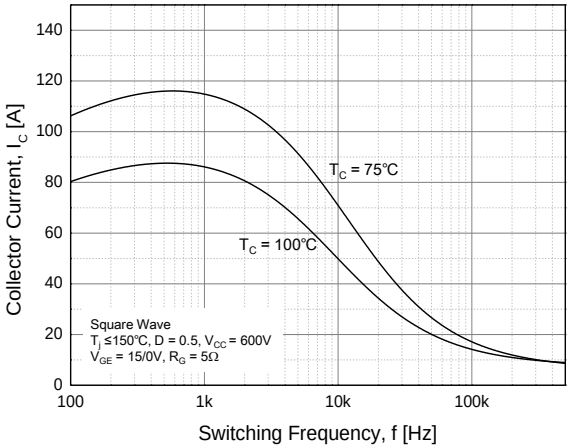



Fig. 17 Load Current vs. Frequency



# Diode Characteristics

Fig. 18 Conduction characteristics

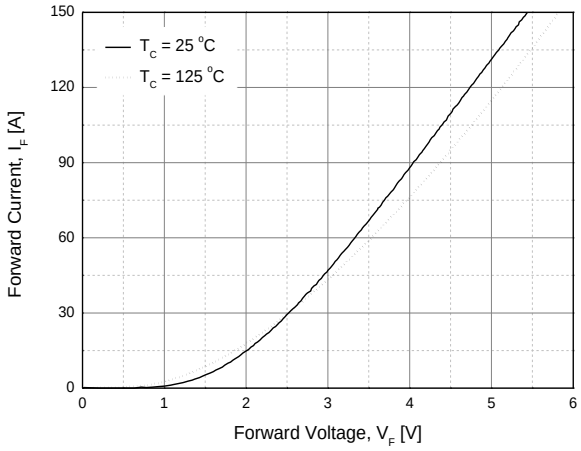



Fig. 19 Reverse recovery current vs. forward current

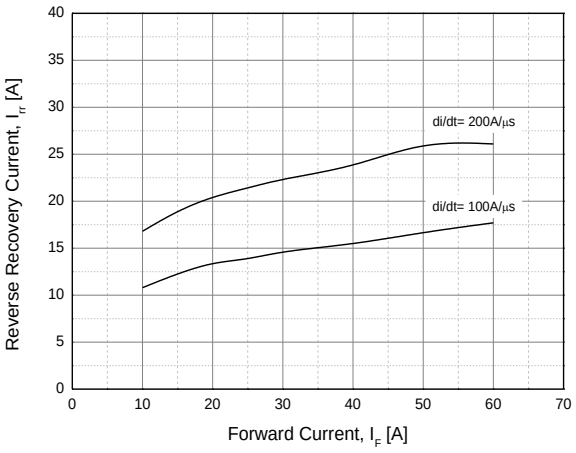



Fig. 20 Reverse recovery charge vs. forward current

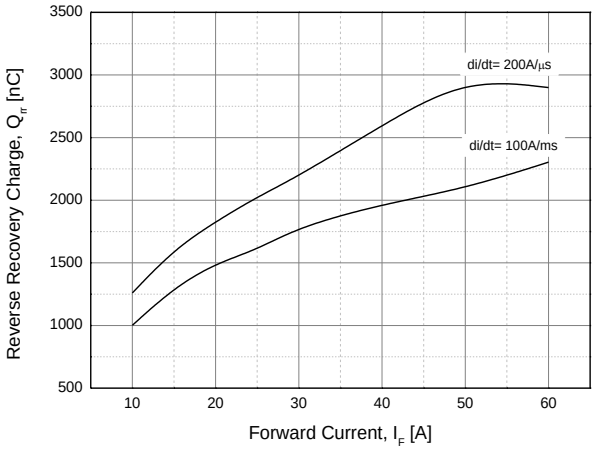
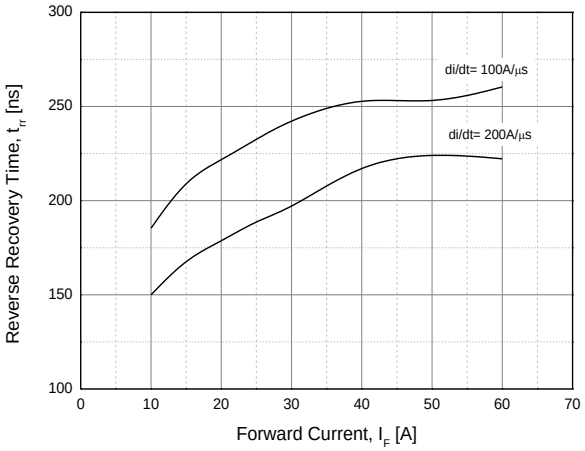
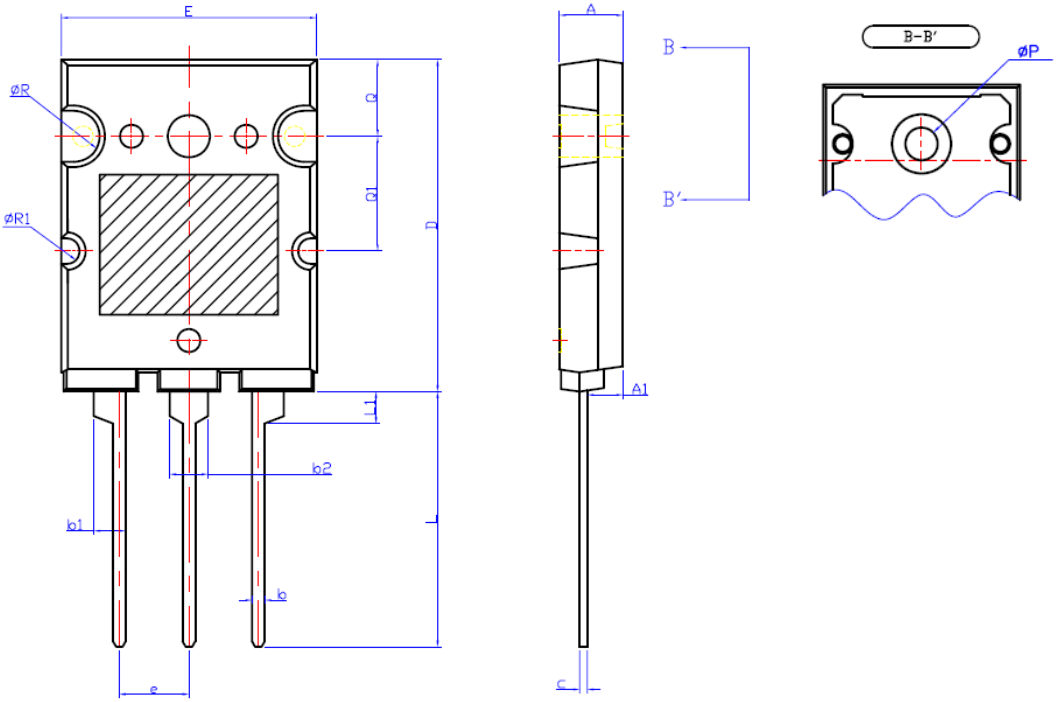



Fig. 21 Reverse recovery time vs. forward current



# TO-264 MECHANICAL DATA




| SYMBOL | MIN | NOM | MAX |
|---|---|---|---|
| A | 4.80 | 5.00 | 5.20 |
| A1 | 2.50 | 2.80 | 3.10 |
| b | 0.90 | 1.00 | 1.25 |
| b1 | 2.30 | 2.50 | 2.70 |
| b2 | 2.80 | 3.00 | 3.20 |
| c | 0.50 | 0.60 | 0.85 |
| D | 25.80 | 26.00 | 26.20 |
| E | 19.80 | 20.00 | 20.20 |
| e | 5.15 | 5.45 | 5.75 |
| L | 19.50 | 20.00 | 20.50 |
| L1 | 2.40 | 2.50 | 2.60 |
| ØP | 3.00 | 3.20 | 3.40 |
| Q | 5.80 | 6.00 | 6.20 |
| Q1 | 8.80 | 9.00 | 9.20 |
| ØR | (2.00) | | |
| ØR1 | (1.00) | | |

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