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FAIRCHILD SEMICONDUCTOR®

February 2008

# FGL40N120AND
# 1200V NPT IGBT

## Features

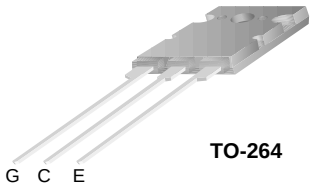
- High speed switching
- Low saturation voltage : $V_{CE(sat)}$ = 2.6 V @ $I_C$ = 40A
- High input impedance
- CO-PAK, IGBT with FRD : $t_{rr}$ = 75ns (typ.)

## Applications

Induction Heating, UPS, AC & DC motor controls and general purpose inverters.

## Description

Employing NPT technology, Fairchild's AND series of IGBTs provides low conduction and switching losses. The AND series offers an solution for application such as induction heating (IH), motor control, general purpose inverters and uninterruptible power supplies (UPS).

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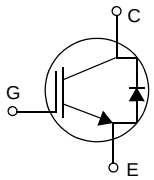



## Absolute Maximum Ratings

| Symbol | Parameter | | FGL40N120AND | Units |
|---|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Voltage | | 1200 | V |
| $V_{GES}$ | Gate-Emitter Voltage | | ±25 | V |
| $I_C$ | Collector Current | @$T_C$ = 25°C | 64 | A |
| | Collector Current | @$T_C$ = 100°C | 40 | A |
| $I_{CM(1)}$ | Pulsed Collector Current | | 160 | A |
| $I_F$ | Diode Continuous Forward Current | @$T_C$ = 100°C | 40 | A |
| $I_{FM}$ | Diode Maximum Forward Current | | 240 | A |
| $P_D$ | Maximum Power Dissipation | @$T_C$ = 25°C | 500 | W |
| | Maximum Power Dissipation | @$T_C$ = 100°C | 200 | W |
| SCWT | Short Circuit Withstand Time, $V_{CE}$ = 600V, $V_{GE}$ = 15V, $T_C$ = 125°C | | 10 | μs |
| $T_J$ | Operating Junction Temperature | | -55 to +150 | °C |
| $T_{STG}$ | Storage Temperature Range | | -55 to +150 | °C |
| $T_L$ | Maximum Lead Temp. for Soldering Purposes, 1/8" from Case for 5 seconds | | 300 | °C |

**Notes:**

(1) Pulse width limited by max. junction temperature

## Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$(IGBT) | Thermal Resistance, Junction-to-Case | -- | 0.25 | °C/W |
| $R_{\theta JC}$(DIODE) | Thermal Resistance, Junction-to-Case | -- | 0.7 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | -- | 25 | °C/W |

## Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|
| FGL40N120AND | FGL40N120AND | TO-264 | - | - | 25 |

## Electrical Characteristics of the IGBT $T_C$ = 25°C unless otherwise noted

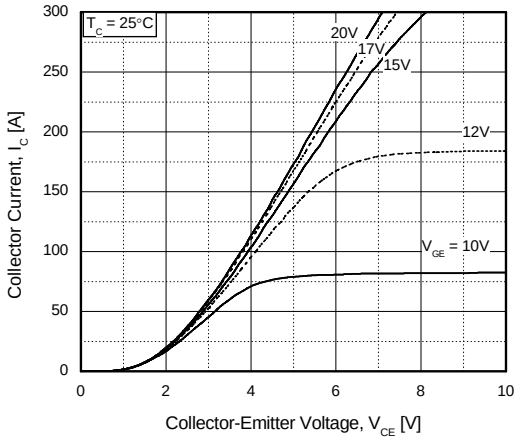
| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{CES}$ | Collector-Emitter Breakdown Voltage | $V_{GE}$ = 0V, $I_C$ = 1mA | 1200 | -- | -- | V |
| $BV_{CES}/\Delta T_J$ | Temperature Coefficient of Breakdown Voltage | $V_{GE}$ = 0V, $I_C$ = 1mA | -- | 0.6 | -- | V/°C |
| $I_{CES}$ | Collector Cut-Off Current | $V_{CE}$ = $V_{CES}$, $V_{GE}$ = 0V | -- | -- | 1 | mA |
| $I_{GES}$ | G-E Leakage Current | $V_{GE}$ = $V_{GES}$, $V_{CE}$ = 0V | -- | -- | ±250 | nA |
| **On Characteristics** | | | | | | |
| $V_{GE(th)}$ | G-E Threshold Voltage | $I_C$ = 250μA, $V_{CE}$ = $V_{GE}$ | 3.5 | 5.5 | 7.5 | V |
| $V_{CE(sat)}$ | Collector to Emitter Saturation Voltage | $I_C$ = 40A, $V_{GE}$ = 15V | -- | 2.6 | 3.2 | V |
| | | $I_C$ = 40A, $V_{GE}$ = 15V, $T_C$ = 125°C | -- | 2.9 | -- | V |
| | | $I_C$ = 64A, $V_{GE}$ = 15V | -- | 3.15 | -- | V |
| **Dynamic Characteristics** | | | | | | |
| $C_{ies}$ | Input Capacitance | $V_{CE}$ = 30V, $V_{GE}$ = 0V f = 1MHz | -- | 3200 | -- | pF |
| $C_{oes}$ | Output Capacitance | | -- | 370 | -- | pF |
| $c_{res}$ | Reverse Transfer Capacitance | | -- | 125 | -- | pF |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC}$ = 600V, $I_C$ = 40A, $R_G$ = 5Ω, $V_{GE}$ = 15V, Inductive Load, $T_C$ = 25°C | -- | 15 | -- | ns |
| $t_r$ | Rise Time | | -- | 20 | -- | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 110 | -- | ns |
| $t_f$ | Fall Time | | -- | 40 | 80 | ns |
| $E_{on}$ | Turn-On Switching Loss | | -- | 2.3 | 3.45 | mJ |
| $E_{off}$ | Turn-Off Switching Loss | | -- | 1.1 | 1.65 | mJ |
| $E_{ts}$ | Total Switching Loss | | -- | 3.4 | 5.1 | mJ |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC}$ = 600V, $I_C$ = 40A, $R_G$ = 5Ω, $V_{GE}$ = 15V, Inductive Load, $T_C$ = 125°C | -- | 20 | -- | ns |
| $t_r$ | Rise Time | | -- | 25 | -- | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 120 | -- | ns |
| $t_f$ | Fall Time | | -- | 45 | -- | ns |
| $E_{on}$ | Turn-On Switching Loss | | -- | 2.5 | -- | mJ |
| $E_{off}$ | Turn-Off Switching Loss | | -- | 1.8 | -- | mJ |
| $E_{ts}$ | Total Switching Loss | | -- | 4.3 | -- | mJ |
| $Q_g$ | Total Gate charge | $V_{CE}$ = 600V, $I_C$ = 40A, $V_{GE}$ = 15V | -- | 220 | 330 | nC |
| $Q_{ge}$ | Gate-Emitter Charge | | -- | 25 | 38 | nC |
| $Q_{gc}$ | Gate-Collector Charge | | -- | 130 | 195 | nC |

## Electrical Characteristics of DIODE $T_C$ = 25°C unless otherwise noted

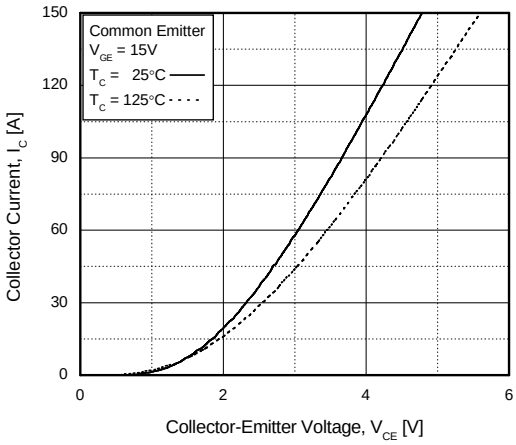
| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| $V_{FM}$ | Diode Forward Voltage | $I_F$ = 40A | $T_C$ = 25°C | -- | 3.2 | 4.0 | V |
| | | | $T_C$ = 125°C | -- | 2.7 | -- | |
| $t_{rr}$ | Diode Reverse Recovery Time | $I_F$ = 40A, di/dt = 200A/μs | $T_C$ = 25°C | -- | 75 | 112 | nS |
| | | | $T_C$ = 125°C | -- | 130 | -- | |
| $I_{rr}$ | Diode Peak Reverse Recovery Current | | $T_C$ = 25°C | -- | 8 | 12 | A |
| | | | $T_C$ = 125°C | -- | 13 | -- | |
| $Q_{rr}$ | Diode Reverse Recovery Charge | | $T_C$ = 25°C | -- | 300 | 450 | nC |
| | | | $T_C$ = 125°C | -- | 845 | -- | |

## Typical Performance Characteristics

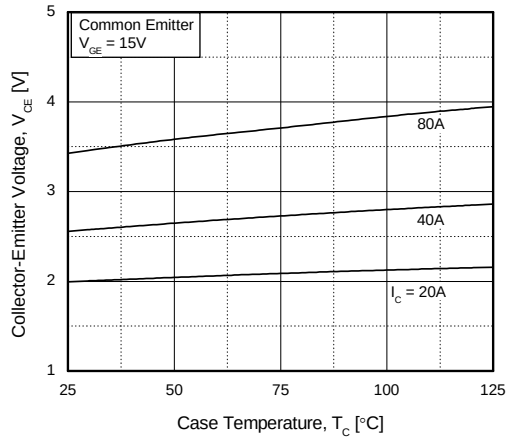
### Figure 1. Typical Output Characteristics



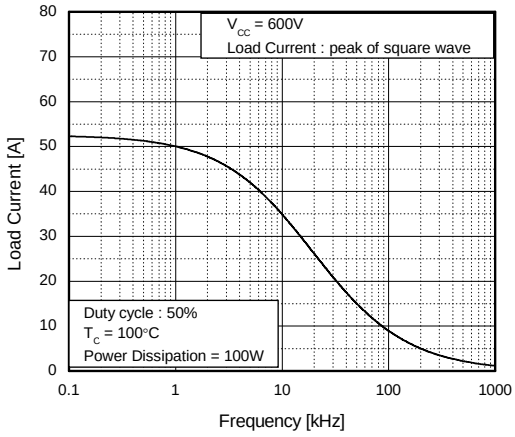

### Figure 2. Typical Saturation Voltage Characteristics



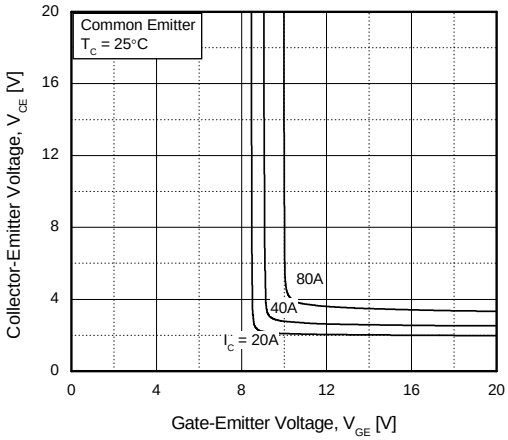

### Figure 3. Saturation Voltage vs. Case Temperature at Variant Current Level



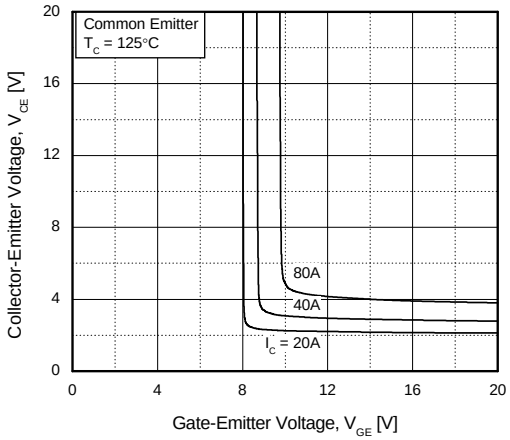

### Figure 4. Load Current vs. Frequency




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

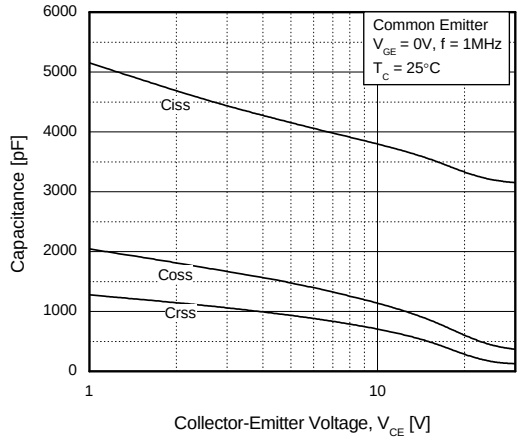



### Figure 6. Saturation Voltage vs. $V_{GE}$

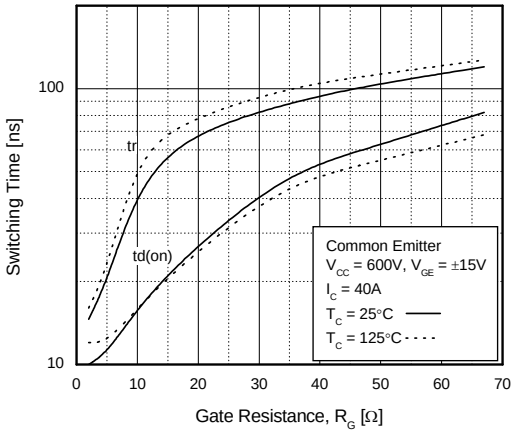


## Typical Performance Characteristics (Continued)

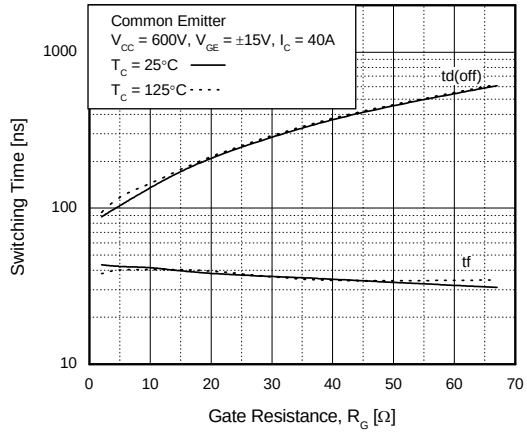
### Figure 7. Capacitance Characteristics



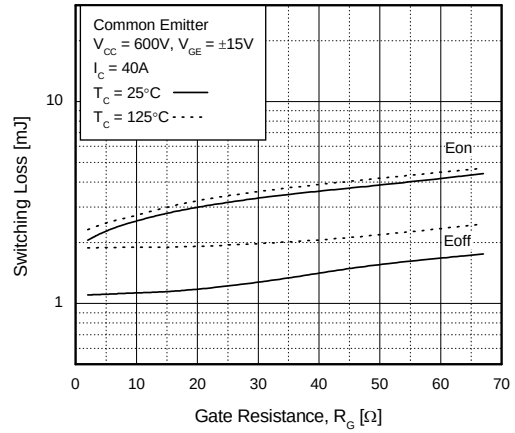

### Figure 8. Turn-On Characteristics vs. Gate Resistance



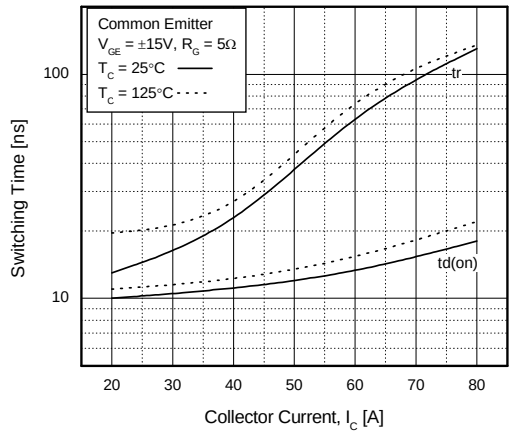

### Figure 9. Turn-Off Characteristics vs. Gate Resistance



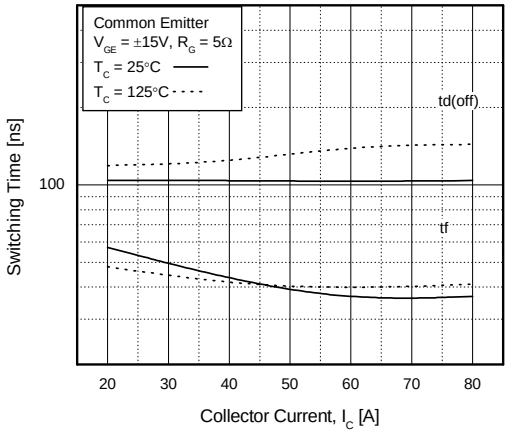

### Figure 10. Switching Loss vs. Gate Resistance




### Figure 11. Turn-On Characteristics vs. Collector Current

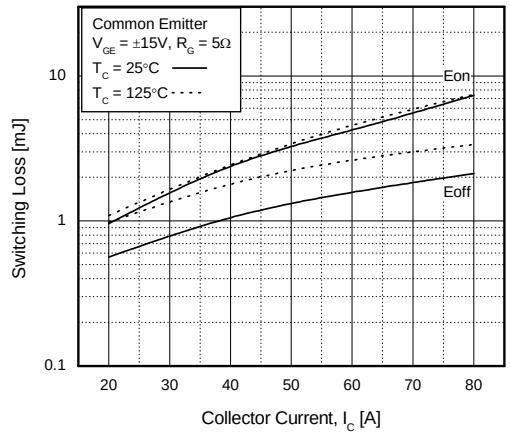



### Figure 12. Turn-Off Characteristics vs. Collector Current

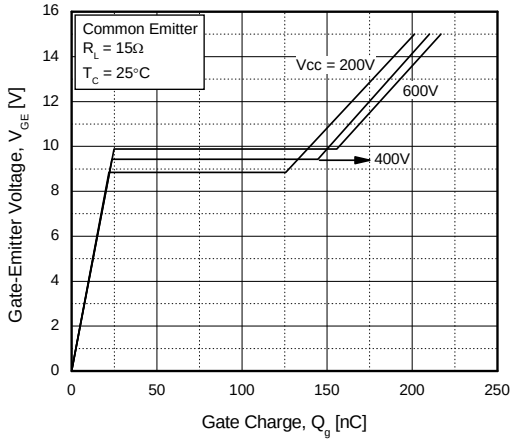


## Typical Performance Characteristics (Continued)

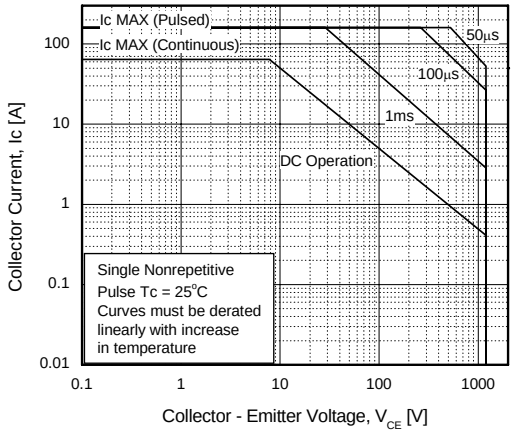
### Figure 13. Switching Loss vs. Collector Current



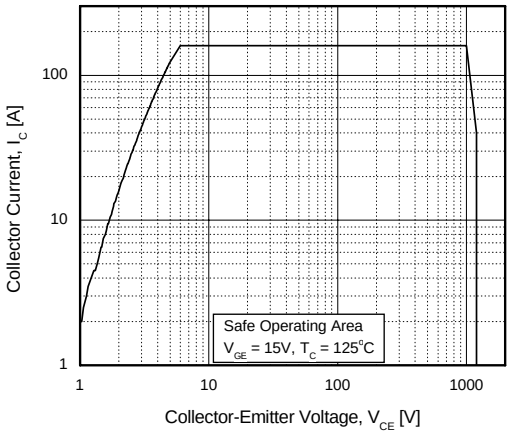

### Figure 14. Gate Charge Characteristics



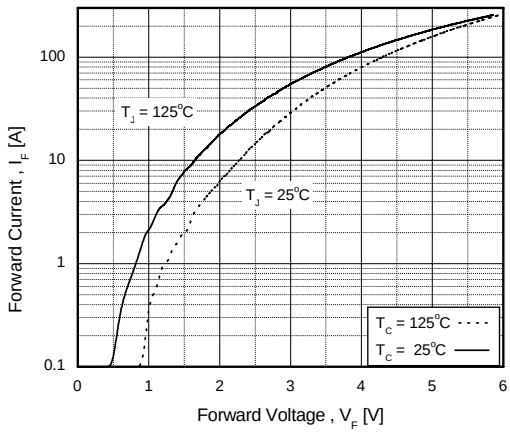

### Figure 15. SOA Characteristics



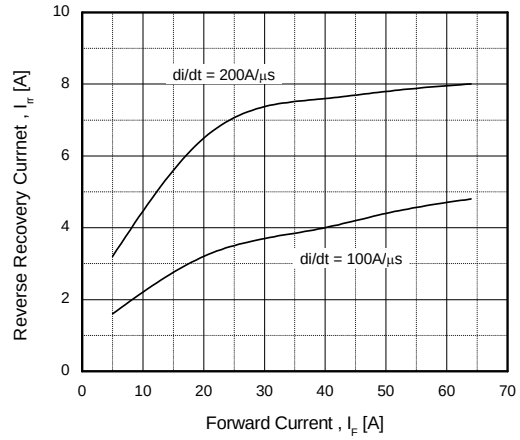

### Figure 16. Turn-Off SOA




### Figure 17. Forward Characteristics

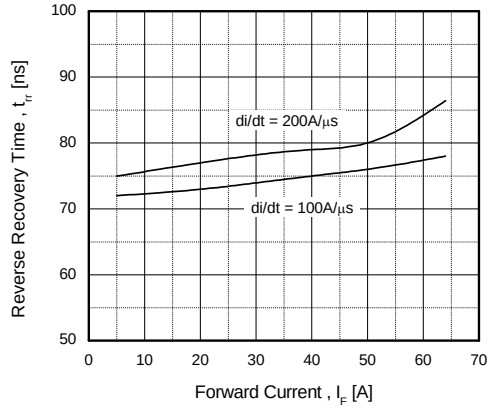



### Figure 18. Reverse Recovery Current

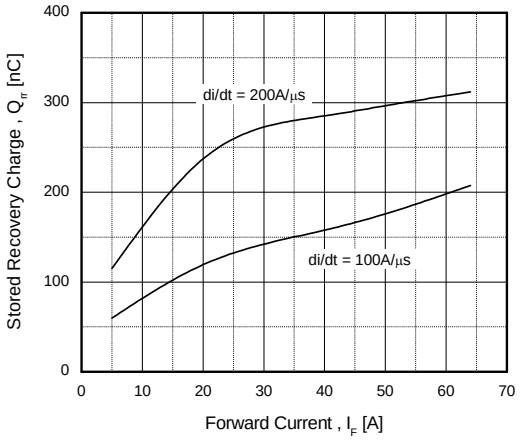


## Typical Performance Characteristics (Continued)

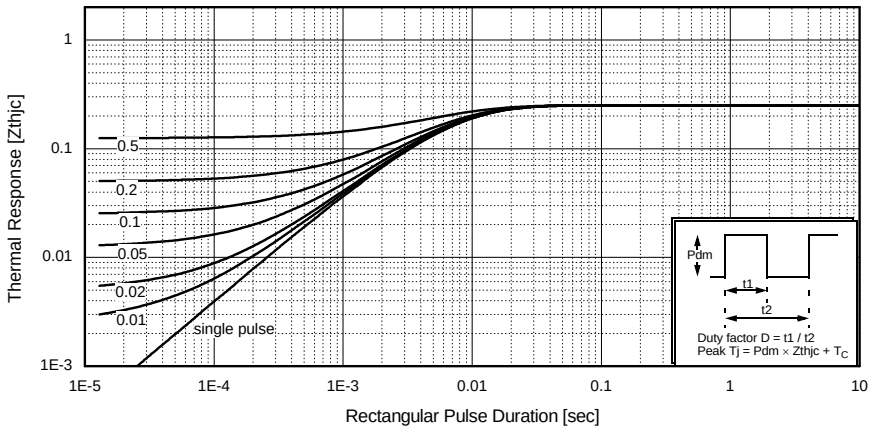
### Figure 19. Stored Charge




### Figure 20. Reverse Recovery Time

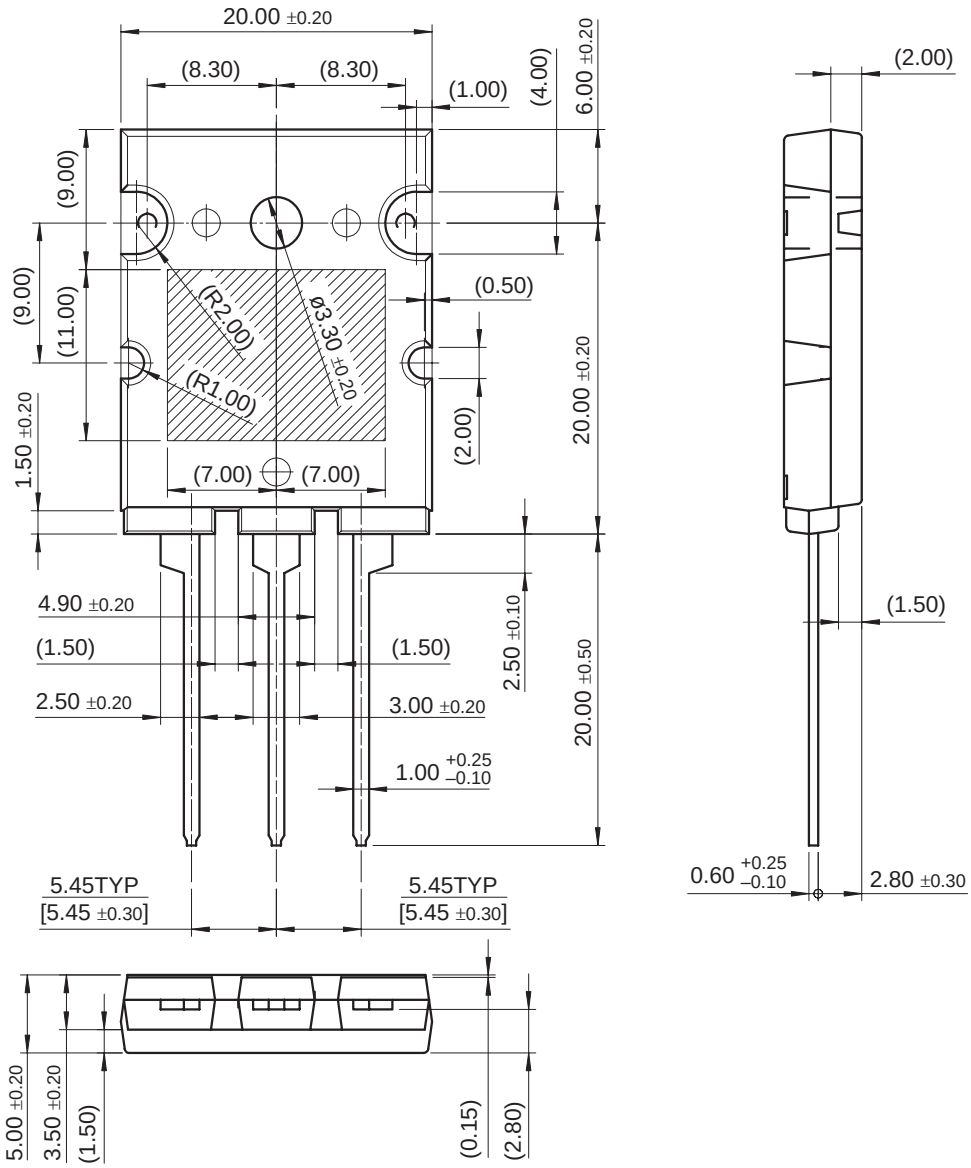



### Figure 21. Transient Thermal Impedance of IGBT



## Mechanical Dimensions

TO-264




Dimensions in Millimeters

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