ON Semiconductor®

# FGA25N120ANTDTU

## 1200 V, 25 A NPT Trench IGBT

### Features

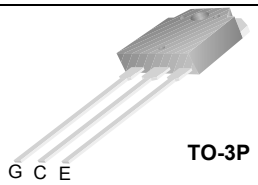
- NPT Trench Technology, Positive Temperature Coefficient
- Low Saturation Voltage: $V_{CE(sat),\ typ}$ = 2.0 V @ $I_C$ = 25 A and $T_C$ = 25°C
- Low Switching Loss: $E_{off,\ typ}$ = 0.96 mJ @ $I_C$ = 25 A and $T_C$ = 25°C
- Extremely Enhanced Avalanche Capability

### Description

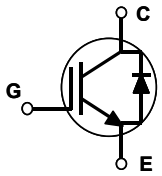
Using ON Semiconductor's proprietary trench design and advanced NPT technology, the 1200V NPT IGBT offers superior conduction and switching performances, high avalanche ruggedness and easy parallel operation. This device is well suited for the reso-nant or soft switching application such as induction heating, microwave oven.

### Applications

- Induction Heating, Microwave Oven




TO-3P




### Absolute Maximum Ratings

| Symbol | Description | | Ratings | Unit |
|---|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Voltage | | 1200 | V |
| $V_{GES}$ | Gate-Emitter Voltage | | ± 20 | V |
| $I_C$ | Collector Current | @ $T_C$ = 25°C | 50 | A |
| | Collector Current | @ $T_C$ = 100°C | 25 | A |
| $I_{CM\ (1)}$ | Pulsed Collector Current | | 90 | A |
| $I_F$ | Diode Continuous Forward Current | @ $T_C$ = 25°C | 50 | A |
| | Diode Continuous Forward Current | @ $T_C$ = 100°C | 25 | A |
| $I_{FM}$ | Diode Maximum Forward Current | | 150 | A |
| $P_D$ | Maximum Power Dissipation | @ $T_C$ = 25°C | 312 | W |
| | Maximum Power Dissipation | @ $T_C$ = 100°C | 125 | W |
| $T_J$ | 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) Repetitive rating: Pulse width limited by max. junction temperature

### Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Unit |
|---|---|---|---|---|
| $R_{\theta JC}$(IGBT) | Thermal Resistance, Junction-to-Case | -- | 0.4 | °C/W |
| $R_{\theta JC}$(DIODE) | Thermal Resistance, Junction-to-Case | -- | 2.0 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | -- | 40 | °C/W |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Publication Order Number:
FGA25N120ANTDTU/D

## Package Marking and Ordering Information

| Part Number | Top Mark | Package | Packing Method | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|---|
| FGA25N120ANTDTU-F109 | FGA25N120ANTDTU | TO-3PN | Tube | N/A | N/A | 30 |

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

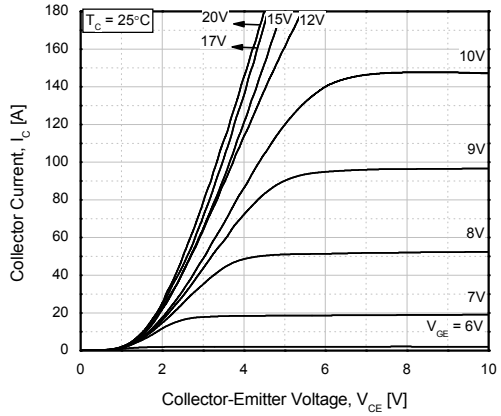
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $I_{CES}$ | Collector Cut-Off Current | $V_{CE} = V_{CES}$, $V_{GE}$ = 0 V | -- | -- | 3 | mA |
| $I_{GES}$ | G-E Leakage Current | $V_{GE} = V_{GES}$, $V_{CE}$ = 0 V | -- | -- | ± 250 | nA |
| **On Characteristics** | | | | | | |
| $V_{GE(th)}$ | G-E Threshold Voltage | $I_C$ = 25 mA, $V_{CE} = V_{GE}$ | 3.5 | 5.5 | 7.5 | V |
| $V_{CE(sat)}$ | Collector to Emitter Saturation Voltage | $I_C$ = 25 A, $V_{GE}$ = 15 V | -- | 2.0 | -- | V |
| | | $I_C$ = 25 A, $V_{GE}$ = 15 V, $T_C$ = 125°C | -- | 2.15 | -- | V |
| | | $I_C$ = 50 A, $V_{GE}$ = 15 V | -- | 2.65 | -- | V |
| **Dynamic Characteristics** | | | | | | |
| $C_{ies}$ | Input Capacitance | $V_{CE}$ = 30 V, $V_{GE}$ = 0 V, f = 1 MHz | -- | 3700 | -- | pF |
| $C_{oes}$ | Output Capacitance | | -- | 130 | -- | pF |
| $C_{res}$ | Reverse Transfer Capacitance | | -- | 80 | -- | pF |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC}$ = 600 V, $I_C$ = 25 A, $R_G$ = 10 Ω, $V_{GE}$ = 15 V, Inductive Load, $T_C$ = 25°C | -- | 50 | -- | ns |
| $t_r$ | Rise Time | | -- | 60 | -- | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 190 | -- | ns |
| $t_f$ | Fall Time | | -- | 100 | -- | ns |
| $E_{on}$ | Turn-On Switching Loss | | -- | 4.1 | -- | mJ |
| $E_{off}$ | Turn-Off Switching Loss | | -- | 0.96 | -- | mJ |
| $E_{ts}$ | Total Switching Loss | | -- | 5.06 | -- | mJ |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC}$ = 600 V, $I_C$ = 25 A, $R_G$ = 10Ω, $V_{GE}$ = 15 V, Inductive Load, $T_C$ = 125°C | -- | 50 | -- | ns |
| $t_r$ | Rise Time | | -- | 60 | -- | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 200 | -- | ns |
| $t_f$ | Fall Time | | -- | 154 | -- | ns |
| $E_{on}$ | Turn-On Switching Loss | | -- | 4.3 | -- | mJ |
| $E_{off}$ | Turn-Off Switching Loss | | -- | 1.5 | -- | mJ |
| $E_{ts}$ | Total Switching Loss | | -- | 5.8 | -- | mJ |
| $Q_g$ | Total Gate Charge | $V_{CE}$ = 600 V, $I_C$ = 25 A, $V_{GE}$ = 15 V | -- | 200 | -- | nC |
| $Q_{ge}$ | Gate-Emitter Charge | | -- | 15 | -- | nC |
| $Q_{gc}$ | Gate-Collector Charge | | -- | 100 | -- | nC |

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

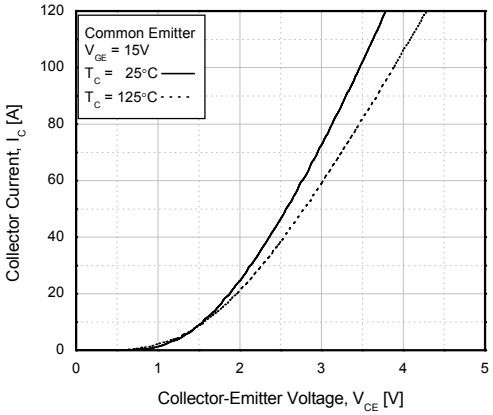
| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{FM}$ | Diode Forward Voltage | $I_F$ = 25 A | $T_C$ = 25°C | -- | 2.0 | 3.0 | V |
| | | | $T_C$ = 125°C | -- | 2.1 | -- | |
| $t_{rr}$ | Diode Reverse Recovery Time | $I_F$ = 25 A<br>$di_F/dt$ = 200 A/μs | $T_C$ = 25°C | -- | 235 | 350 | ns |
| | | | $T_C$ = 125°C | -- | 300 | -- | |
| $I_{rr}$ | Diode Peak Reverse Recovery Current | | $T_C$ = 25°C | -- | 27 | 40 | A |
| | | | $T_C$ = 125°C | -- | 31 | -- | |
| $Q_{rr}$ | Diode Reverse Recovery Charge | | $T_C$ = 25°C | -- | 3130 | 4700 | nC |
| | | | $T_C$ = 125°C | -- | 4650 | -- | |

## Typical Performance Characteristics

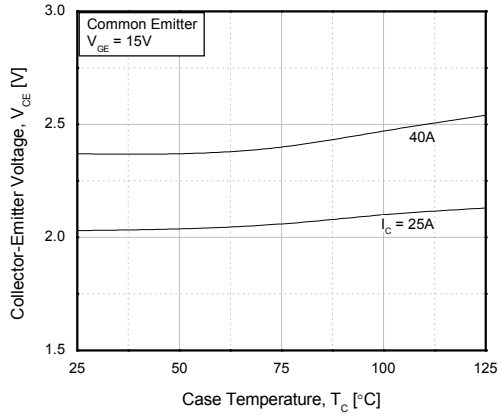
### Figure 1. Typical Output Characteristics



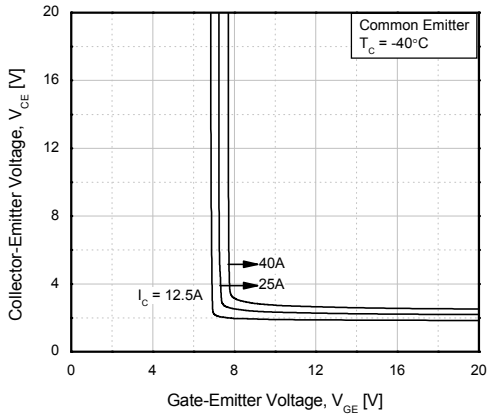

### Figure 2. Typical Saturation Voltage Characteristics



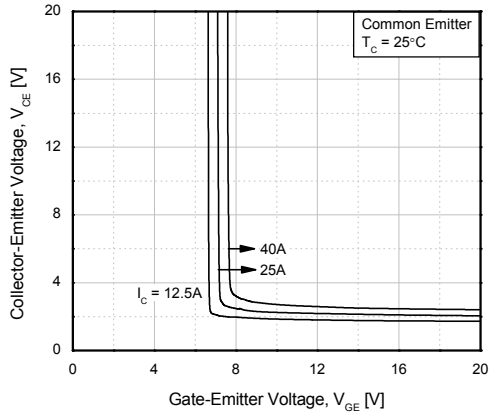

### Figure 3. Saturation Voltage vs. Case Temperature at Variant Current Level



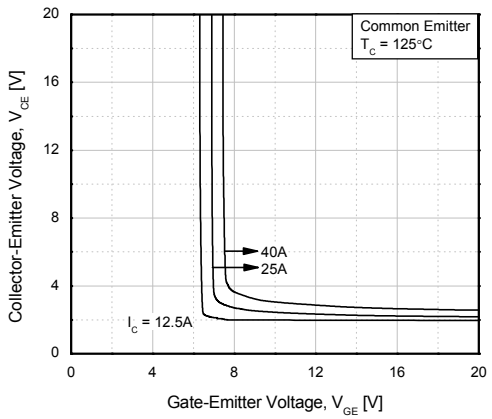

### Figure 4. Saturation Voltage vs. $V_{GE}$




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

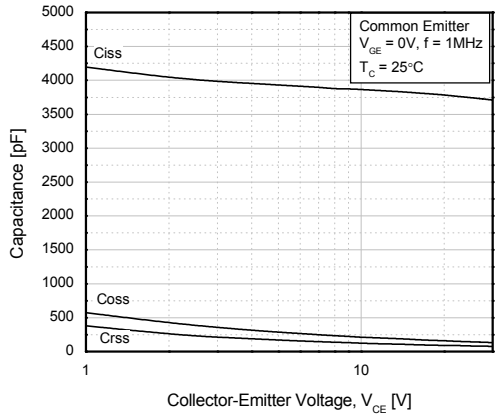



### Figure 6. Saturation Voltage vs. $V_{GE}$

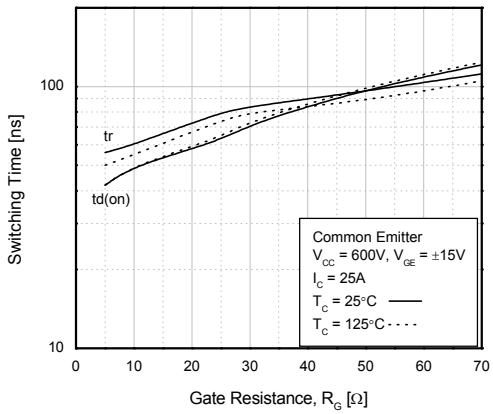


## Typical Performance Characteristics (Continued)

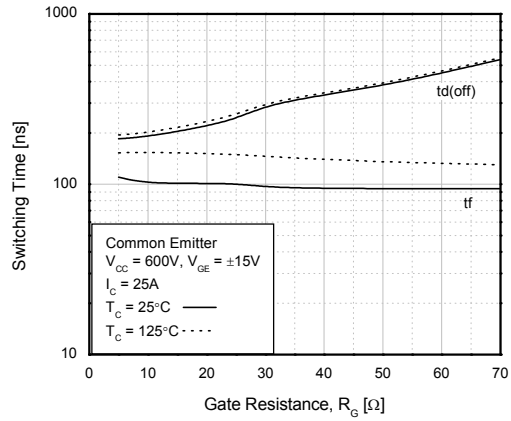
### Figure 7. Capacitance Characteristics



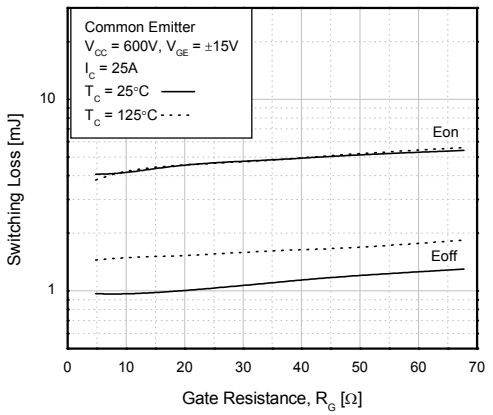

### Figure 8. Turn-On Characteristics vs. Gate Resistance



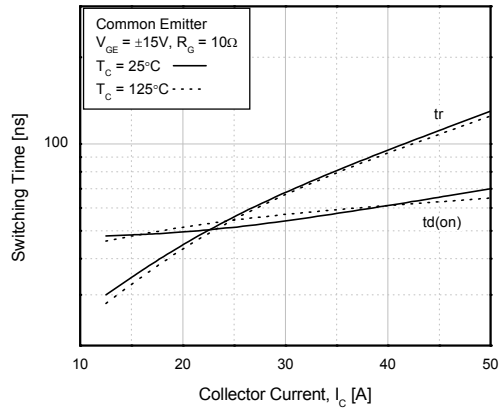

### Figure 9. Turn-Off Characteristics vs. Gate Resistance



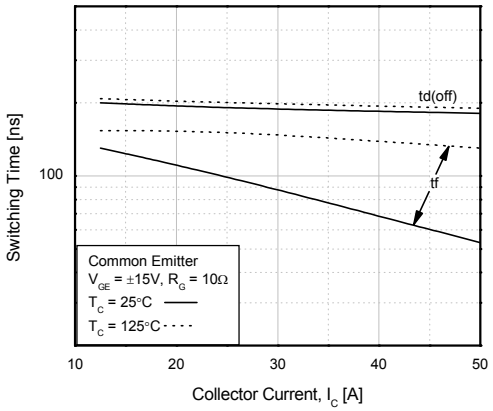

### Figure 10. Switching Loss vs. Gate Resistance




### 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**

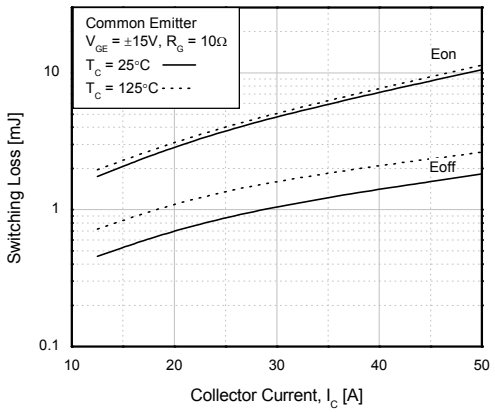



**Figure 14. Gate Charge Characteristics**

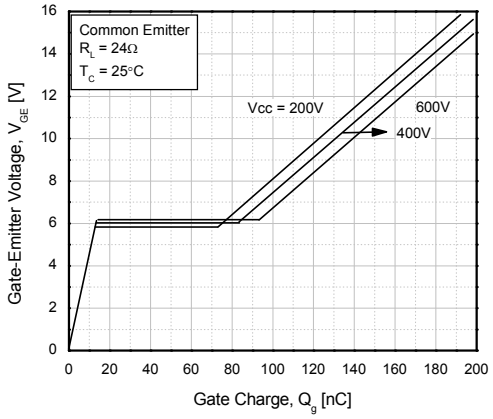



**Figure 15. SOA Characteristics**

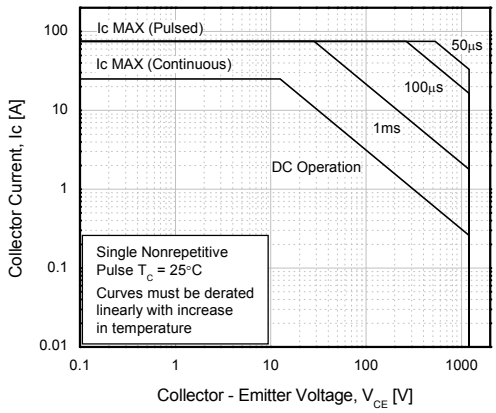



**Figure 16. Turn-Off SOA**

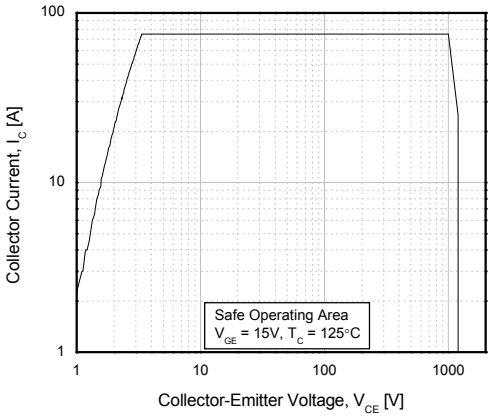
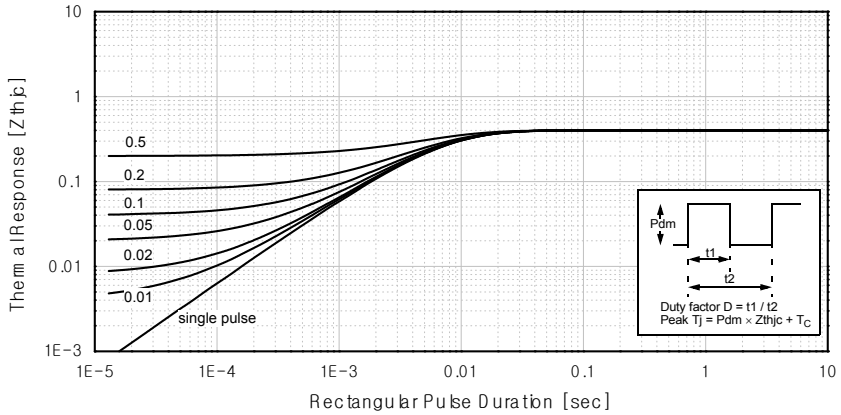



**Figure 17. Transient Thermal Impedance of IGBT**



## Typical Performance Characteristics (Continued)

**Figure 18. Forward Characteristics**

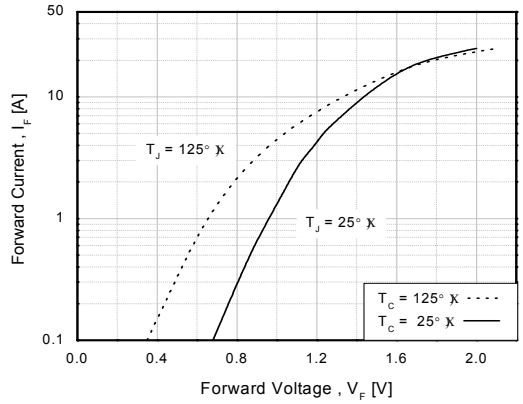



**Figure 19. Reverse Recovery Current**

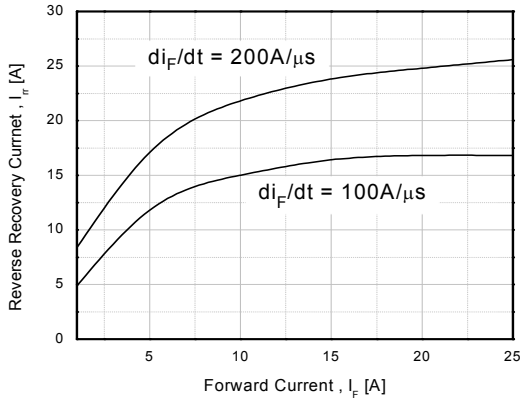



**Figure 20. Stored Charge**

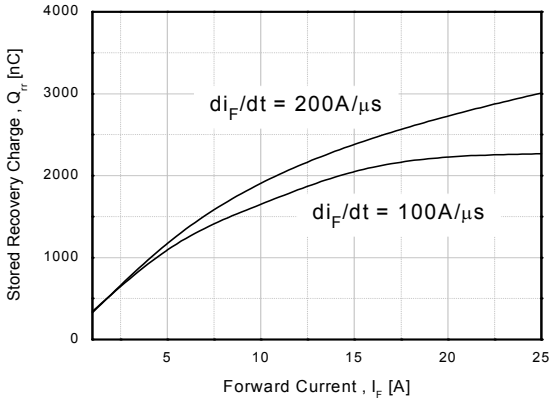
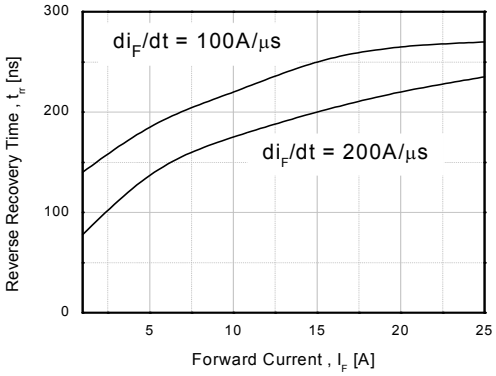



**Figure 21. Reverse Recovery Time**



## Mechanical Dimensions

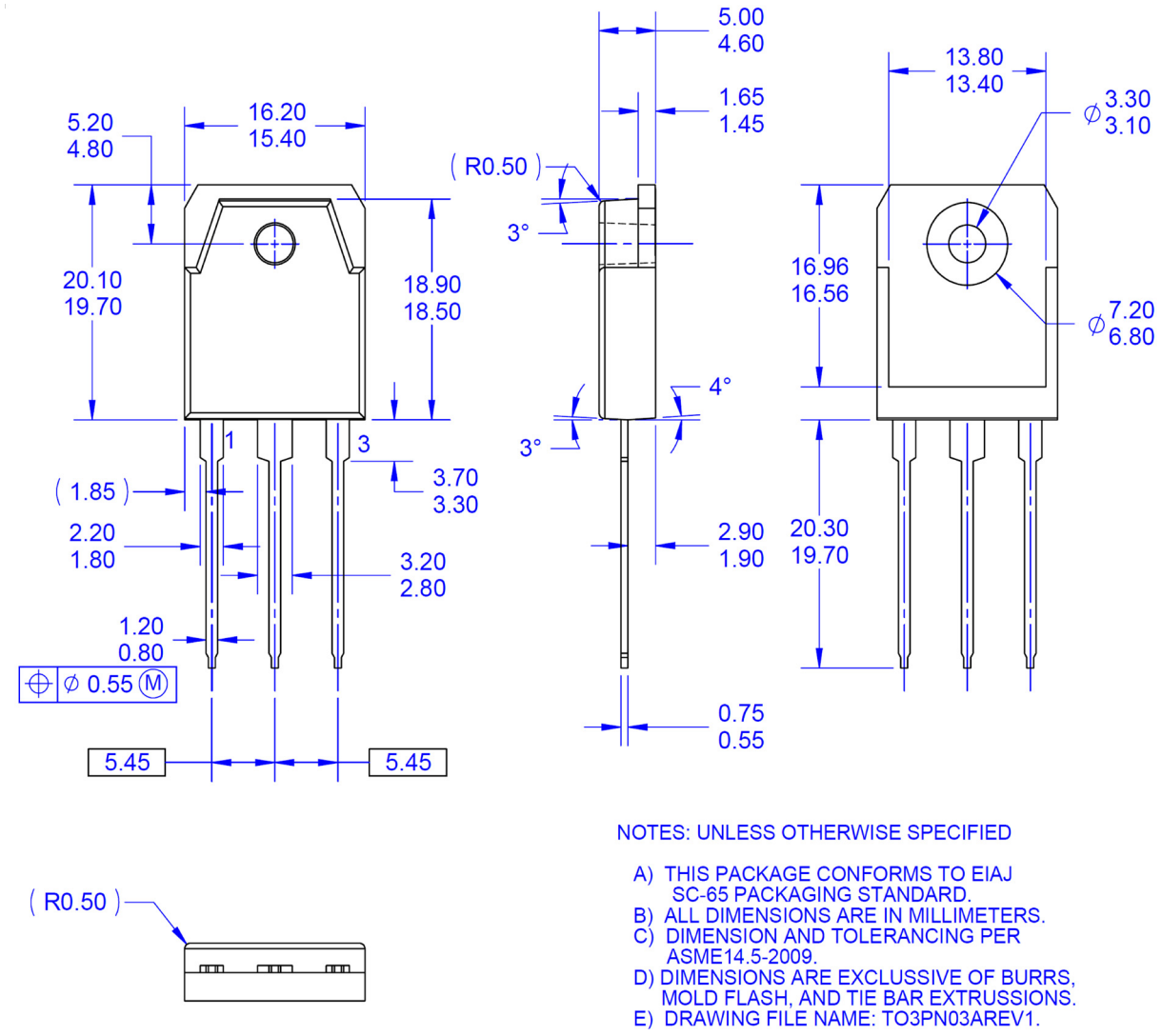



**Figure 22. TO3PN, 3-Lead, Plastic, EIAJ SC-65**

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