# NGTB30N120L2WG

# IGBT − Field Stop II

This Insulated Gate Bipolar Transistor (IGBT) features a robust and cost effective Field Stop II Trench construction, and provides superior performance in demanding switching applications, offering both low on state voltage and minimal switching loss. The IGBT is well suited for motor driver applications. Incorporated into the device is a soft and fast co−packaged free wheeling diode with a low forward voltage.

### Features

- Extremely Efficient Trench with Field Stop Technology
- $T_{Jmax}$ = 175°C
- Soft Fast Reverse Recovery Diode
- Optimized for Low $V_{CEsat}$
- 10 μs Short Circuit Capability
- These are Pb−Free Devices

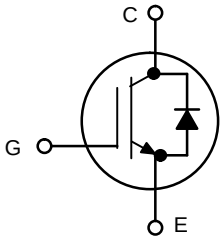
### Typical Applications

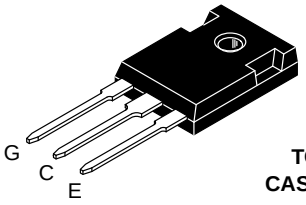
- Motor Drive Inverter
- Industrial Switching
- Welding

**ON Semiconductor®**

**http://onsemi.com**

**30 A, 1200 V**
**$V_{CEsat}$ = 1.70 V**
**$E_{off}$ = 1.4 mJ**



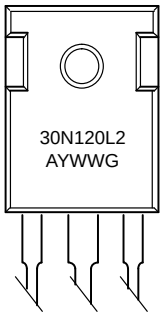

**TO−247**
**CASE 340AL**

### ABSOLUTE MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector−emitter voltage | $V_{CES}$ | 1200 | V |
| Collector current<br>@ Tc = 25°C<br>@ Tc = 100°C | $I_C$ | <br>60<br>30 | A |
| Pulsed collector current, $T_{pulse}$ limited by $T_{Jmax}$, 10 μs Pulse, $V_{GE}$ = 15 V | $I_{CM}$ | 120 | A |
| Diode forward current<br>@ Tc = 25°C<br>@ Tc = 100°C | $I_F$ | <br>60<br>30 | A |
| Diode pulsed current, $T_{pulse}$ limited by $T_{Jmax}$ | $I_{FM}$ | 120 | A |
| Gate−emitter voltage<br>Transient gate−emitter voltage ($T_{pulse}$ = 5 μs, D < 0.10) | $V_{GE}$ | ±20<br>±30 | V |
| Power Dissipation<br>@ Tc = 25°C<br>@ Tc = 100°C | $P_D$ | <br>534<br>267 | W |
| Short Circuit Withstand Time<br>$V_{GE}$ = 15 V, $V_{CE}$ = 500 V, $T_J \le$ 150°C | $T_{SC}$ | 10 | μs |
| Operating junction temperature range | $T_J$ | −55 to +175 | °C |
| Storage temperature range | $T_{stg}$ | −55 to +175 | °C |
| Lead temperature for soldering, 1/8” from case for 5 seconds | $T_{SLD}$ | 260 | °C |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

### MARKING DIAGRAM




A = Assembly Location
Y = Year
WW = Work Week
G = Pb−Free Package

### ORDERING INFORMATION

| Device | Package | Shipping |
|---|---|---|
| NGTB30N120L2WG | TO−247<br>(Pb−Free) | 30 Units / Rail |

## THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal resistance junction−to−case, for IGBT | $R_{\theta JC}$ | 0.28 | °C/W |
| Thermal resistance junction−to−case, for Diode | $R_{\theta JC}$ | 0.85 | °C/W |
| Thermal resistance junction−to−ambient | $R_{\theta JA}$ | 40 | °C/W |

## ELECTRICAL CHARACTERISTICS ($T_J$ = 25°C unless otherwise specified)

| Parameter | Test Conditions | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **STATIC CHARACTERISTIC** | | | | | | |
| Collector−emitter breakdown voltage, gate−emitter short−circuited | $V_{GE}$ = 0 V, $I_C$ = 500 μA | $V_{(BR)CES}$ | 1200 | − | − | V |
| Collector−emitter saturation voltage | $V_{GE}$ = 15 V, $I_C$ = 30 A<br>$V_{GE}$ = 15 V, $I_C$ = 30 A, $T_J$ = 175°C | $V_{CEsat}$ | −<br>− | 1.70<br>2.07 | 1.90<br>− | V |
| Gate−emitter threshold voltage | $V_{GE}$ = $V_{CE}$, $I_C$ = 400 μA | $V_{GE(th)}$ | 4.5 | 5.5 | 6.5 | V |
| Collector−emitter cut−off current, gate−emitter short−circuited | $V_{GE}$ = 0 V, $V_{CE}$ = 1200 V<br>$V_{GE}$ = 0 V, $V_{CE}$ = 1200 V, $T_J$ = 175°C | $I_{CES}$ | −<br>− | −<br>− | 1.0<br>2 | mA |
| Gate leakage current, collector−emitter short−circuited | $V_{GE}$ = 20 V , $V_{CE}$ = 0 V | $I_{GES}$ | − | − | 200 | nA |
| Input capacitance | $V_{CE}$ = 20 V, $V_{GE}$ = 0 V, f = 1 MHz | $C_{ies}$ | − | 7500 | − | pF |
| Output capacitance | | $C_{oes}$ | − | 200 | − | |
| Reverse transfer capacitance | | $C_{res}$ | − | 140 | − | |
| Gate charge total | $V_{CE}$ = 600 V, $I_C$ = 30 A, $V_{GE}$ = 15 V | $Q_g$ | − | 310 | − | nC |
| Gate to emitter charge | | $Q_{ge}$ | − | 61 | − | |
| Gate to collector charge | | $Q_{gc}$ | − | 150 | − | |
| **SWITCHING CHARACTERISTIC, INDUCTIVE LOAD** | | | | | | |
| Turn−on delay time | $T_J$ = 25°C<br>$V_{CC}$ = 600 V, $I_C$ = 30 A<br>$R_g$ = 10 Ω<br>$V_{GE}$ = 0 V/ 15V | $t_{d(on)}$ | − | 116 | − | ns |
| Rise time | | $t_r$ | − | 35 | − | |
| Turn−off delay time | | $t_{d(off)}$ | − | 285 | − | |
| Fall time | | $t_f$ | − | 175 | − | |
| Turn−on switching loss | | $E_{on}$ | − | 4.4 | − | mJ |
| Turn−off switching loss | | $E_{off}$ | − | 1.4 | − | |
| Total switching loss | | $E_{ts}$ | − | 5.8 | − | |
| Turn−on delay time | $T_J$ = 175°C<br>$V_{CC}$ = 600 V, $I_C$ = 30 A<br>$R_g$ = 10 Ω<br>$V_{GE}$ = 0 V/ 15V | $t_{d(on)}$ | − | 110 | − | ns |
| Rise time | | $t_r$ | − | 36 | − | |
| Turn−off delay time | | $t_{d(off)}$ | − | 300 | − | |
| Fall time | | $t_f$ | − | 331 | − | |
| Turn−on switching loss | | $E_{on}$ | − | 5.5 | − | mJ |
| Turn−off switching loss | | $E_{off}$ | − | 2.5 | − | |
| Total switching loss | | $E_{ts}$ | − | 8.0 | − | |
| **DIODE CHARACTERISTIC** | | | | | | |
| Forward voltage | $V_{GE}$ = 0 V, $I_F$ = 30 A<br>$V_{GE}$ = 0 V, $I_F$ = 30 A, $T_J$ = 175°C | $V_F$ | −<br>− | 1.50<br>1.40 | 1.70<br>− | V |
| Reverse recovery time | $T_J$ = 25°C<br>$I_F$ = 30 A, $V_R$ = 400 V<br>$di_F/dt$ = 200 A/μs | $t_{rr}$ | − | 450 | − | ns |
| Reverse recovery charge | | $Q_{rr}$ | − | 7.85 | − | μc |
| Reverse recovery current | | $I_{rrm}$ | − | 32 | − | A |

## TYPICAL CHARACTERISTICS

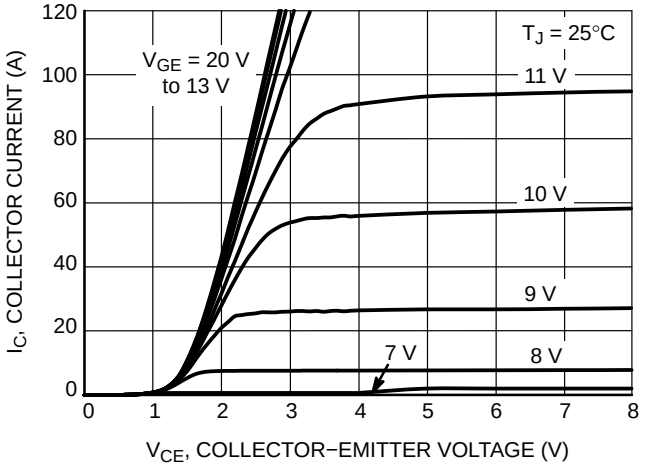



**Figure 1. Output Characteristics**

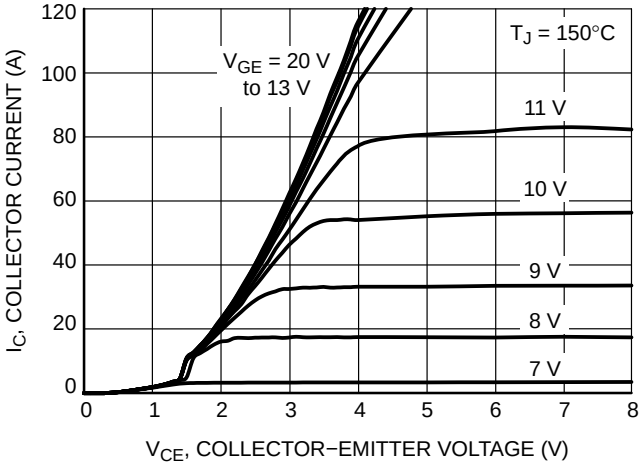



**Figure 2. Output Characteristics**

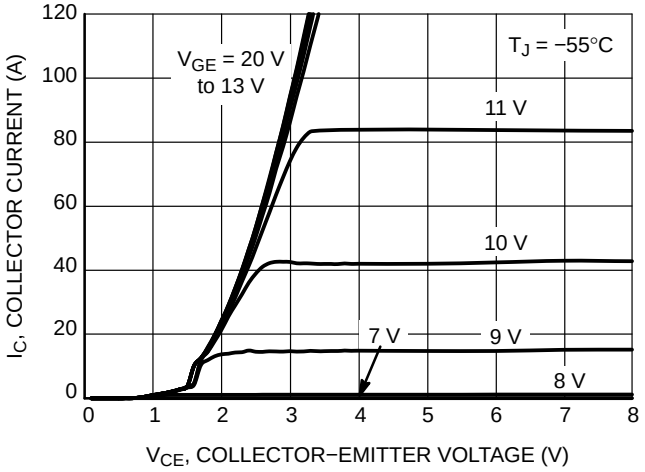



**Figure 3. Output Characteristics**

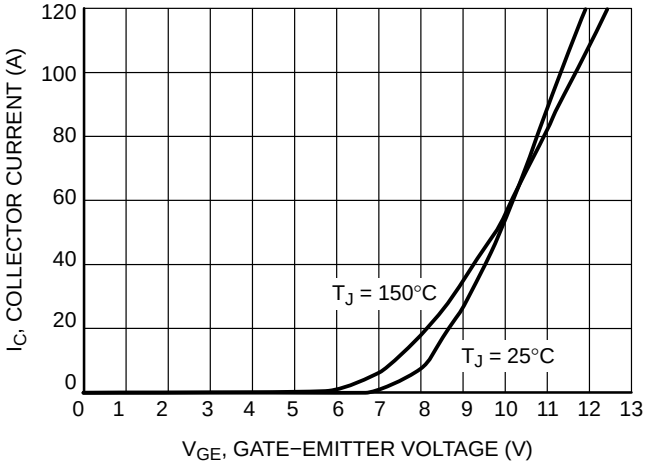



**Figure 4. Typical Transfer Characteristics**

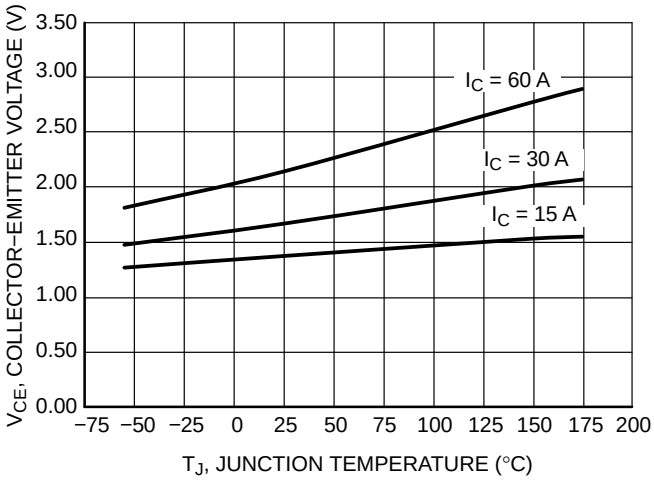



**Figure 5. $V_{CE(sat)}$ vs $T_J$**

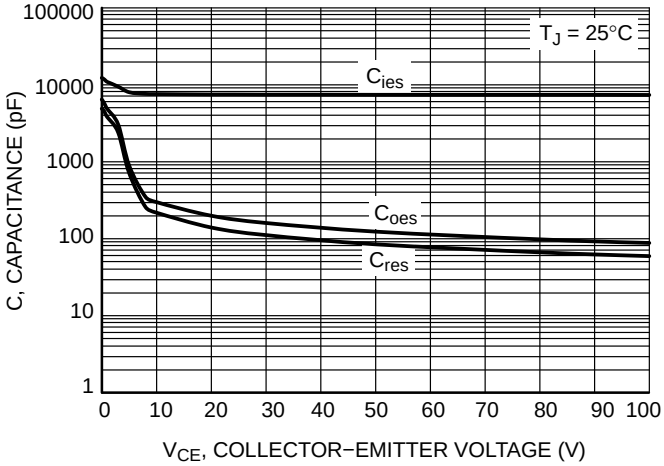



**Figure 6. Typical Capacitance**

## TYPICAL CHARACTERISTICS

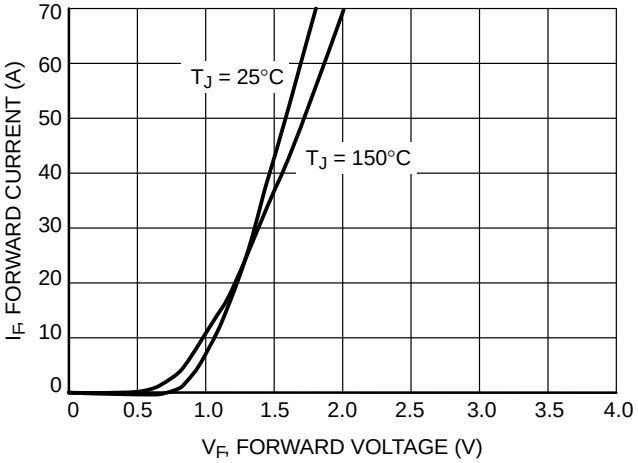



**Figure 7. Diode Forward Characteristics**

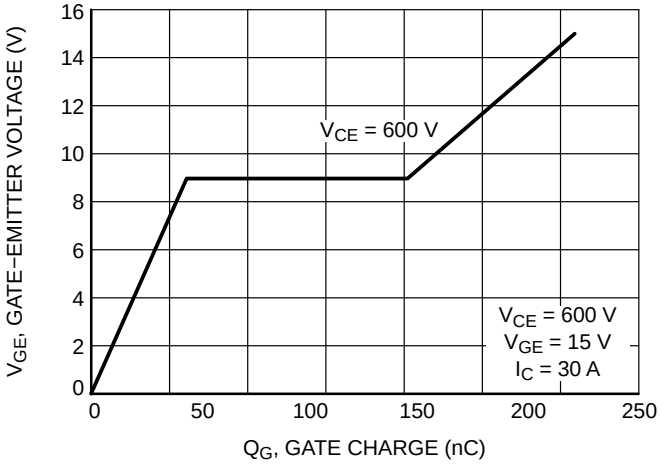



**Figure 8. Typical Gate Charge**

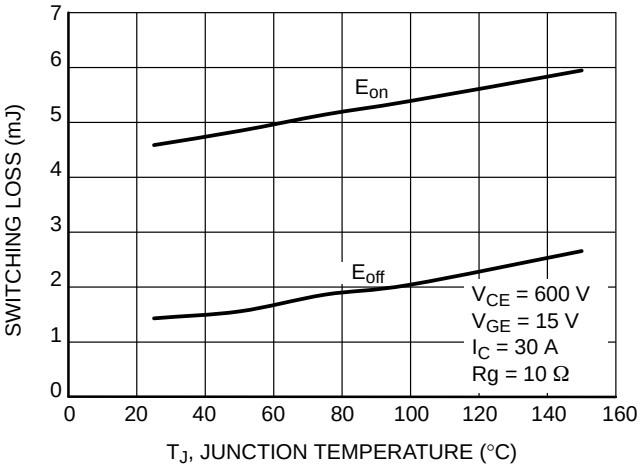



**Figure 9. Switching Loss vs. Temperature**

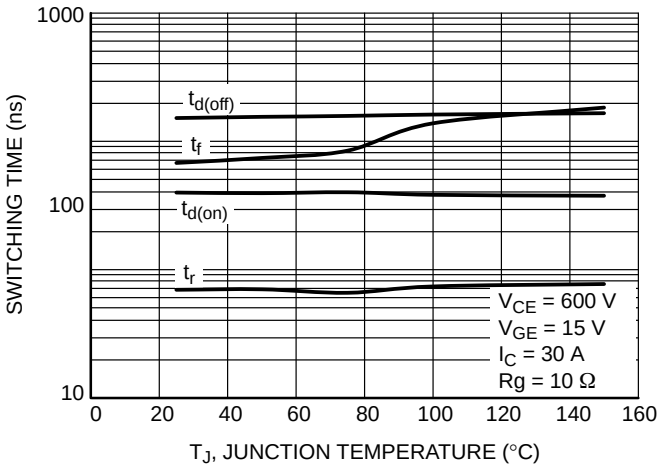



**Figure 10. Switching Time vs. Temperature**

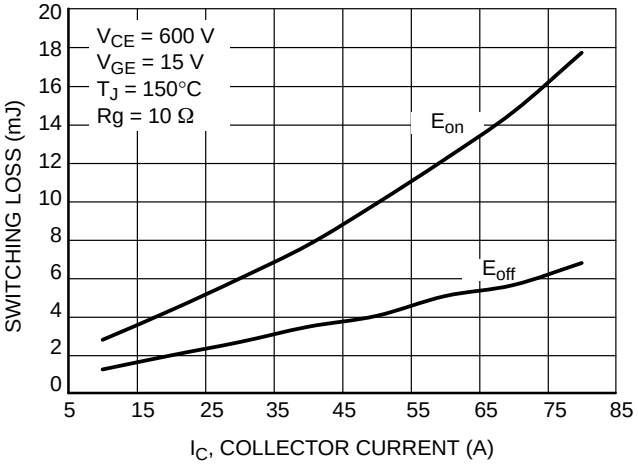



**Figure 11. Switching Loss vs. $I_C$**

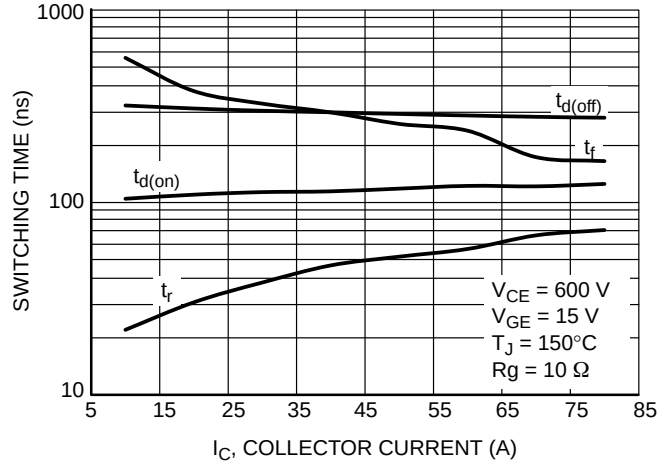



**Figure 12. Switching Time vs. $I_C$**

## TYPICAL CHARACTERISTICS

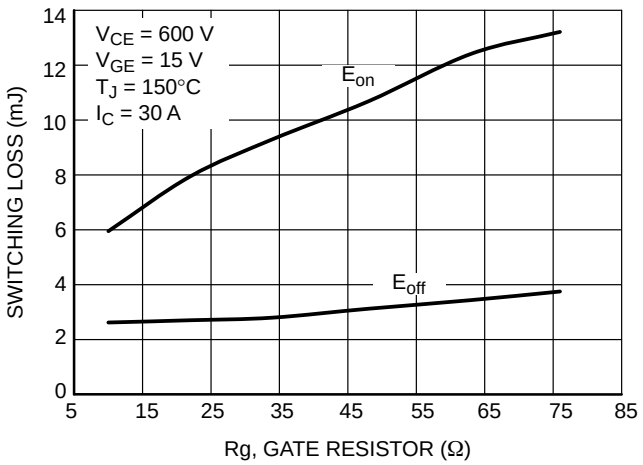



**Figure 13. Switching Loss vs. Rg**

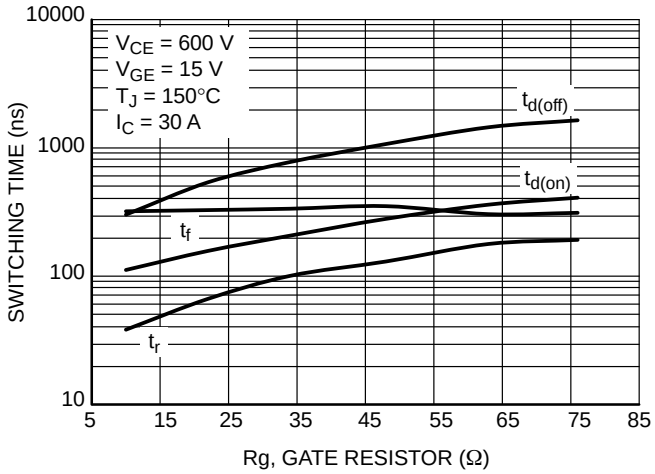



**Figure 14. Switching Time vs. Rg**

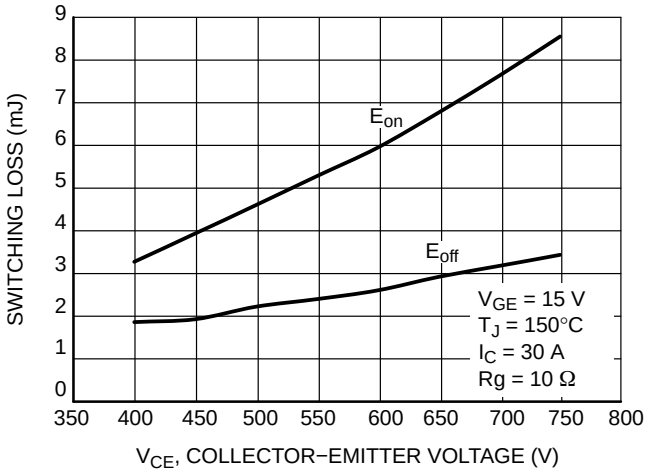



**Figure 15. Switching Loss vs. $V_{CE}$**

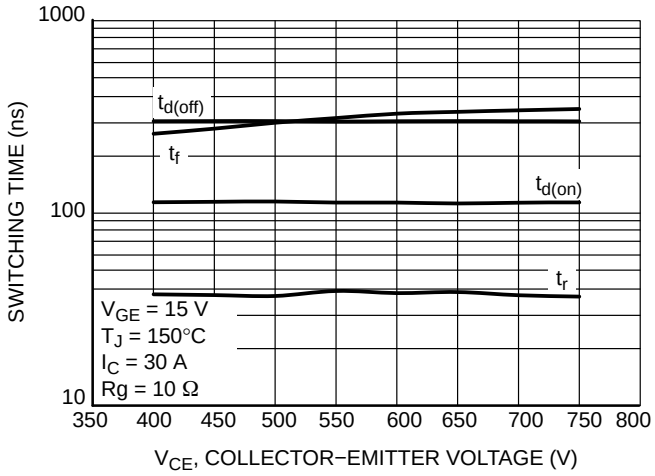



**Figure 16. Switching Time vs. $V_{CE}$**

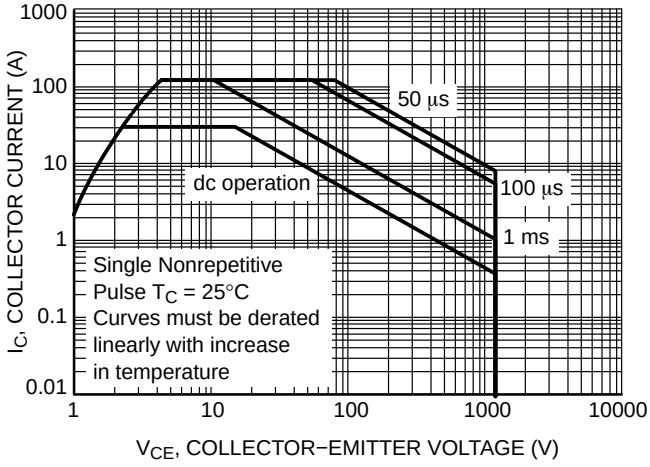



**Figure 17. Safe Operating Area**

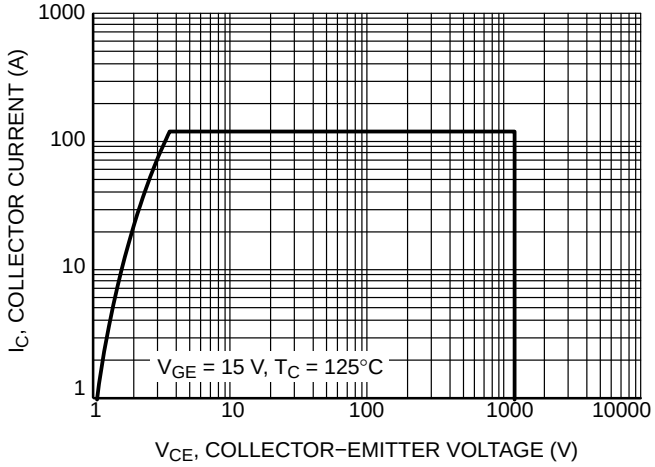



**Figure 18. Reverse Bias Safe Operating Area**

## TYPICAL CHARACTERISTICS

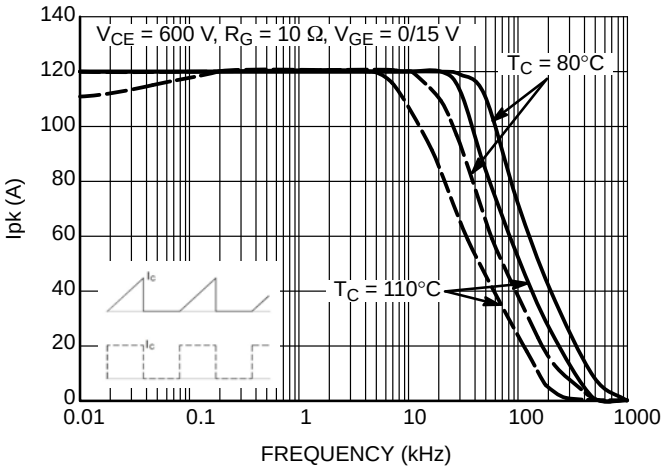
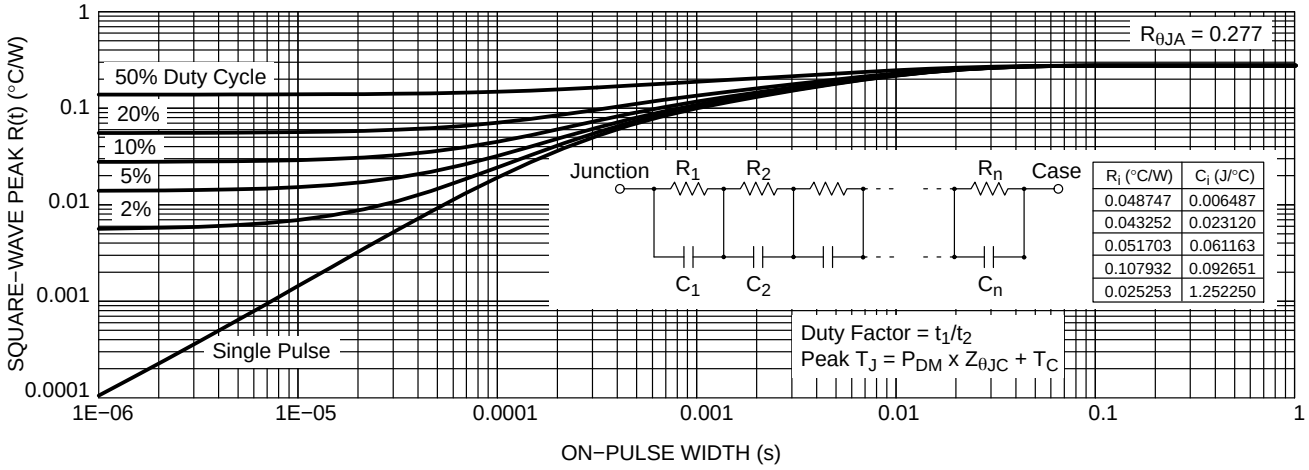
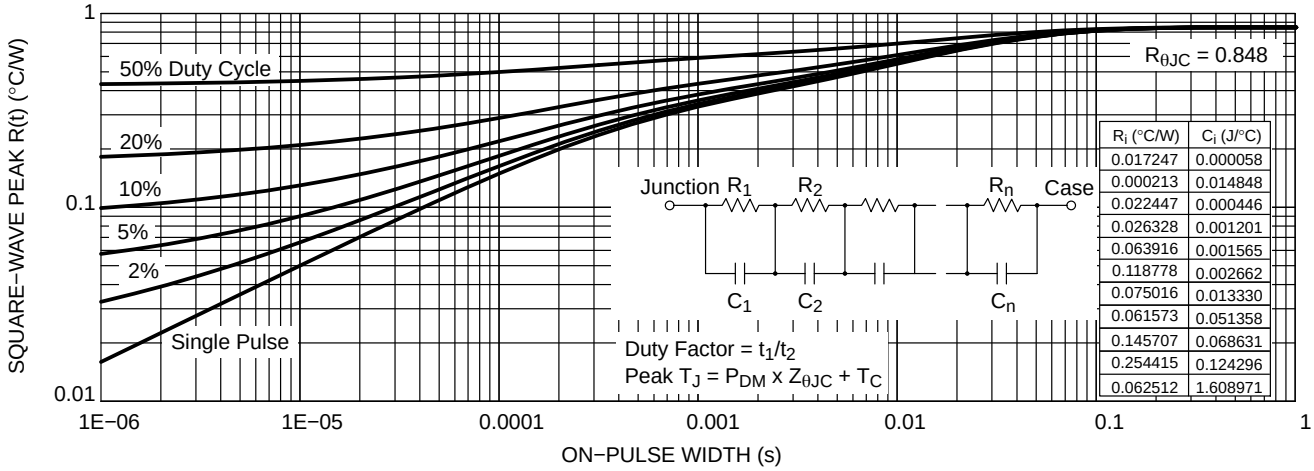



**Figure 19. Collector Current vs. Switching Frequency**




| $R_i$ (°C/W) | $C_i$ (J/°C) |
|---|---|
| 0.048747 | 0.006487 |
| 0.043252 | 0.023120 |
| 0.051703 | 0.061163 |
| 0.107932 | 0.092651 |
| 0.025253 | 1.252250 |

**Figure 20. IGBT Transient Thermal Impedance**




| $R_i$ (°C/W) | $C_i$ (J/°C) |
|---|---|
| 0.017247 | 0.000058 |
| 0.000213 | 0.014848 |
| 0.022447 | 0.000446 |
| 0.026328 | 0.001201 |
| 0.063916 | 0.001565 |
| 0.118778 | 0.002662 |
| 0.075016 | 0.013330 |
| 0.061573 | 0.051358 |
| 0.145707 | 0.068631 |
| 0.254415 | 0.124296 |
| 0.062512 | 1.608971 |

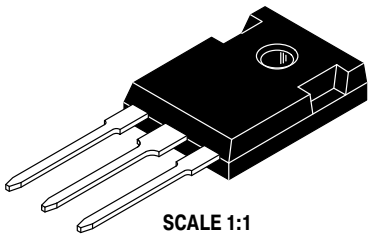
**Figure 21. Diode Transient Thermal Impedance**

# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

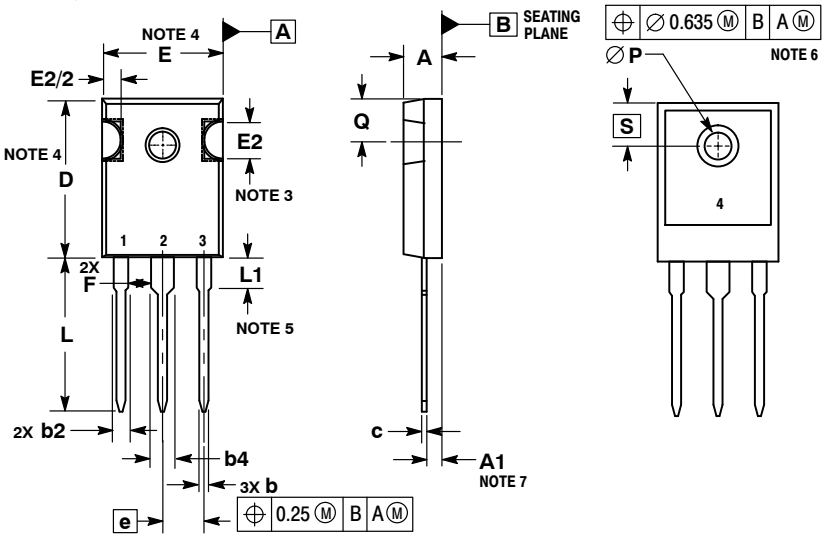
ON Semiconductor®

**TO−247**
CASE 340AL
ISSUE D

DATE 17 MAR 2017



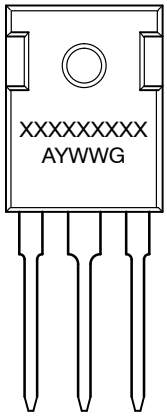
SCALE 1:1




NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. SLOT REQUIRED, NOTCH MAY BE ROUNDED.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.13 PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREME OF THE PLASTIC BODY.
5. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.
6. ∅P SHALL HAVE A MAXIMUM DRAFT ANGLE OF 1.5° TO THE TOP OF THE PART WITH A MAXIMUM DIAMETER OF 3.91.
7. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.

| | MILLIMETERS | |
|---|---|---|
| DIM | MIN | MAX |
| A | 4.70 | 5.30 |
| A1 | 2.20 | 2.60 |
| b | 1.07 | 1.33 |
| b2 | 1.65 | 2.35 |
| b4 | 2.60 | 3.40 |
| c | 0.45 | 0.68 |
| D | 20.80 | 21.34 |
| E | 15.50 | 16.25 |
| E2 | 4.32 | 5.49 |
| e | 5.45 BSC | |
| F | 2.655 | --- |
| L | 19.80 | 20.80 |
| L1 | 3.81 | 4.32 |
| P | 3.55 | 3.65 |
| Q | 5.40 | 6.20 |
| S | 6.15 BSC | |

### GENERIC MARKING DIAGRAM*




XXXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
G = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking.
Pb−Free indicator, “G” or microdot “ ▪”, may or may not be present.

| DOCUMENT NUMBER: | 98AON16119F | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red. |
|---|---|---|
| DESCRIPTION: | TO−247 | PAGE 1 OF 1 |

## ADDITIONAL INFORMATION

**TECHNICAL PUBLICATIONS**:
**Technical Library:** www.onsemi.com/design/resources/technical−documentation
**onsemi Website:** www.onsemi.com

**ONLINE SUPPORT**: www.onsemi.com/support
**For additional information, please contact your local Sales Representative at** www.onsemi.com/support/sales