# IGBT – Power, Co-PAK
## N-Channel, Field Stop VII (FS7), Non SCR, Power TO247-3L, 1200 V, 1.7 V, 75 A

# FGY75T120SWD

| $BV_{CES}$ | $V_{CE(SAT)}$ | $I_C$ |
|---|---|---|
| 1200 V | 1.7 V | 75.0 A |

### Description

Using the novel field stop 7th generation IGBT technology and the Gen7 Diode in TO247 3−lead package, FGY75T120SWD offers the optimum performance with low switching and conduction losses for high−efficiency operations in various applications like Solar, UPS and ESS.

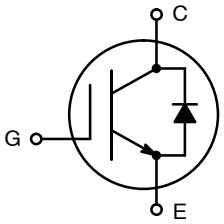
### Features

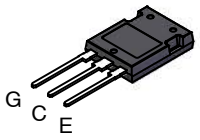
- Maximum Junction Temperature – $T_J$ = 175°C
- Positive Temperature Coefficient for Easy Parallel Operation
- High Current Capability
- Smooth and Optimized Switching
- Low Switching Loss
- RoHS Compliant

### Applications

- Boost and Inverter in Solar System
- UPS
- Energy Storage System

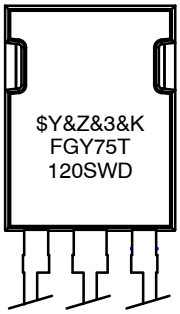
### PIN CONNECTIONS




**TO247−3LD**
**CASE 340CD**

### MARKING DIAGRAM




| | |
|---|---|
| $Y | = **onsemi** Logo |
| &Z | = Assembly Plant Code |
| &3 | = 3−Digit Date Code |
| &K | = 2−Digit Lot Traceability Code |
| FGY75T120SWD | = Specific Device code |

### MAXIMUM RATINGS ($T_J$ = 25°C unless otherwise noted)

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Collector to Emitter Voltage | | $V_{CES}$ | 1200 | V |
| Gate to Emitter Voltage | | $V_{GES}$ | ±20 | |
| Transient Gate to Emitter Voltage | | | ±30 | |
| Collector Current | $T_C$ = 25°C | $I_C$ | 150 | A |
| | $T_C$ = 100°C | | 75 | |
| Power Dissipation | $T_C$ = 25°C | $P_D$ | 503 | W |
| | $T_C$ = 100°C | | 251 | |
| Pulsed Collector Current | $T_C$ = 25°C, $t_p$ = 10 μs (Note 1) | $I_{CM}$ | 300 | A |
| Diode Forward Current | $T_C$ = 25°C | $I_F$ | 150 | |
| | $T_C$ = 100°C | | 75 | |
| Pulsed Diode Maximum Forward Current | $T_C$ = 25°C, $t_p$ = 10 μs (Note 1) | $I_{FM}$ | 300 | |
| Operating Junction and Storage Temperature | | $T_J$, $T_{STG}$ | −55 to 175 | °C |
| Lead Temperature for Soldering Purposes | | $T_L$ | 260 | |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.
1. Repetitive rating: pulse width limited by max. Junction temperature.

### ORDERING INFORMATION

| Device | Package | Shipping |
|---|---|---|
| FGY75T120SWD | TO247−3LD (Pb−Free) | 30 Units / Tube |

## THERMAL CHARACTERISTICS

| Parameter | Symbol | Max Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case for IGBT | $R_{\theta JC}$ | 0.3 | °C/W |
| Thermal Resistance, Junction to Case for Diode | | 0.4 | |
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 40 | |

## ELECTRICAL CHARACTERISTICS OF THE IGBT ($T_J$ = 25°C unless otherwise noted)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Collector to Emitter Breakdown Voltage | $BV_{CES}$ | $V_{GE}$ = 0 V, $I_C$ = 5 mA | 1200 | – | – | V |
| Breakdown Voltage Temperature Coefficient | $\Delta BV_{CES} / \Delta T_J$ | $V_{GE}$ = 0 V, $I_C$ = 5 mA | – | 666 | – | mV/°C |
| Collector to Emitter Cut−Off Current | $I_{CES}$ | $V_{GE}$ = 0 V, $V_{CE}$ = $V_{CES}$ | – | – | 40 | μA |
| Gate to Emitter Leakage Current | $I_{GES}$ | $V_{GE}$ = 20 V, $V_{CE}$ = 0 V | – | – | ±400 | nA |
| **ON CHARACTERISTICS** | | | | | | |
| Gate to Emitter Threshold Voltage | $V_{GE(TH)}$ | $V_{GE}$ = $V_{CE}$, $I_C$ = 75 mA | 5.6 | 6.55 | 7.4 | V |
| Collector to Emitter Saturation Voltage | $V_{CE(SAT)}$ | $V_{GE}$ = 15 V, $I_C$ = 75 A, $T_J$ = 25°C | 1.35 | 1.68 | 2.0 | V |
| | | $V_{GE}$ = 15 V, $I_C$ = 75 A, $T_J$ = 175°C | – | 2.24 | – | |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Input Capacitance | $C_{IES}$ | $V_{CE}$ = 30 V, $V_{GE}$ = 0 V, f = 1 MHz | – | 6331 | – | pF |
| Output Capacitance | $C_{OES}$ | | – | 234 | – | |
| Reverse Transfer Capacitance | $C_{RES}$ | | – | 29.6 | – | |
| Total Gate Charge | $Q_G$ | $V_{CE}$ = 600 V, $V_{GE}$ = 15 V, $I_C$ = 75 A | – | 214 | – | nC |
| Gate to Emitter Charge | $Q_{GE}$ | | – | 53.9 | – | |
| Gate to Collector Charge | $Q_{GC}$ | | – | 77.7 | – | |
| **SWITCHING CHARACTERISTIC, INDUCTIVE LOAD** | | | | | | |
| Turn−On Delay Time | $t_{d(on)}$ | $V_{CE}$ = 600 V, $V_{GE}$ = 15 V, $I_C$ = 37.5 A, $R_G$ = 4.7 Ω, $T_J$ = 25°C | – | 42 | – | ns |
| Turn-Off Delay Time | $t_{d(off)}$ | | – | 221 | – | ns |
| Rise Time | $t_r$ | | – | 27 | – | ns |
| Fall Time | $t_f$ | | – | 77 | – | |
| Turn-On Switching Loss | $E_{on}$ | | – | 2.12 | – | mJ |
| Turn-Off Switching Loss | $E_{off}$ | | – | 1.43 | – | |
| Total Switching Loss | $E_{ts}$ | | – | 3.55 | – | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{CE}$ = 600 V, $V_{GE}$ = 15 V, $I_C$ = 75 A, $R_G$ = 4.7 Ω, $T_J$ = 25°C | – | 42 | – | ns |
| Turn-Off Delay Time | $t_{d(off)}$ | | – | 171 | – | ns |
| Rise Time | $t_r$ | | – | 56 | – | ns |
| Fall Time | $t_f$ | | – | 66 | – | |
| Turn-On Switching Loss | $E_{on}$ | | – | 5.00 | – | mJ |
| Turn-Off Switching Loss | $E_{off}$ | | – | 2.32 | – | |
| Total Switching Loss | $E_{ts}$ | | – | 7.32 | – | |

**ELECTRICAL CHARACTERISTICS OF THE IGBT** ($T_J$ = 25°C unless otherwise noted) (continued)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **SWITCHING CHARACTERISTIC, INDUCTIVE LOAD** | | | | | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{CE}$ = 600 V, $V_{GE}$ = 15 V, $I_C$ = 37.5 A, $R_G$ = 4.7 Ω, $T_J$ = 175°C | – | 38 | – | ns |
| Turn−Off Delay Time | $t_{d(off)}$ | | – | 276 | – | ns |
| Rise Time | $t_r$ | | – | 26 | – | ns |
| Fall Time | $t_f$ | | – | 132 | – | |
| Turn-On Switching Loss | $E_{on}$ | | – | 3.50 | – | mJ |
| Turn−Off Switching Loss | $E_{off}$ | | – | 2.31 | – | |
| Total Switching Loss | $E_{ts}$ | | – | 5.81 | – | |
| Turn−On Delay Time | $t_{d(on)}$ | $V_{CE}$ = 600 V, $V_{GE}$ = 15 V, $I_C$ = 75 A, $R_G$ = 4.7 Ω, $T_J$ = 175°C | – | 38 | – | ns |
| Turn−Off Delay Time | $t_{d(off)}$ | | – | 210 | – | ns |
| Rise Time | $t_r$ | | – | 53 | – | ns |
| Fall Time | $t_f$ | | – | 115 | – | |
| Turn-On Switching Loss | $E_{on}$ | | – | 7.29 | – | mJ |
| Turn-Off Switching Loss | $E_{off}$ | | – | 3.50 | – | |
| Total Switching Loss | $E_{ts}$ | | – | 10.79 | – | |
| **DIODE CHARACTERISTIC** | | | | | | |
| Diode Forward Voltage | $V_F$ | $I_F$ = 75 A, $T_J$ = 25°C | 1.62 | 1.84 | 2.22 | V |
| | | $I_F$ = 75 A, $T_J$ = 175°C | – | 1.91 | – | |
| **DIODE SWITCHING CHARACTERISTIC, INDUCTIVE LOAD** | | | | | | |
| Reverse Recovery Time | $t_{rr}$ | $V_R$ = 600 V, $I_F$ = 37.5 A, $dI_F/dt$ = 500 A/μs, $T_J$ = 25°C | – | 233 | – | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | – | 2343 | – | nC |
| Reverse Recovery Energy | $E_{rec}$ | | – | 0.8 | – | mJ |
| Peak Reverse Recovery Current | $I_{RRM}$ | | – | 20.2 | – | A |
| Reverse Recovery Time | $t_{rr}$ | $V_R$ = 600 V, $I_F$ = 75 A, $dI_F/dt$ = 500 A/μs, $T_J$ = 25°C | – | 307 | – | nS |
| Reverse Recovery Charge | $Q_{rr}$ | | – | 3285 | – | nC |
| Reverse Recovery Energy | $E_{rec}$ | | – | 1 | – | mJ |
| Peak Reverse Recovery Current | $I_{RRM}$ | | – | 21.4 | – | A |
| Reverse Recovery Time | $t_{rr}$ | $V_R$ = 600 V, $I_F$ = 37.5 A, $dI_F/dt$ = 500 A/μs, $T_J$ = 175°C | – | 407 | – | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | – | 5965 | – | nC |
| Reverse Recovery Energy | $E_{rec}$ | | – | 2 | – | mJ |
| Peak Reverse Recovery Current | $I_{RRM}$ | | – | 29.4 | – | A |
| Reverse Recovery Time | $t_{rr}$ | $V_R$ = 600 V, $I_F$ = 75 A, $dI_F/dt$ = 500 A/μs, $T_J$ = 175°C | – | 541 | – | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | – | 8974 | – | nC |
| Reverse Recovery Energy | $E_{rec}$ | | – | 4 | – | mJ |
| Peak Reverse Recovery Current | $I_{RRM}$ | | – | 33.2 | – | A |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

## TYPICAL CHARACTERISTICS

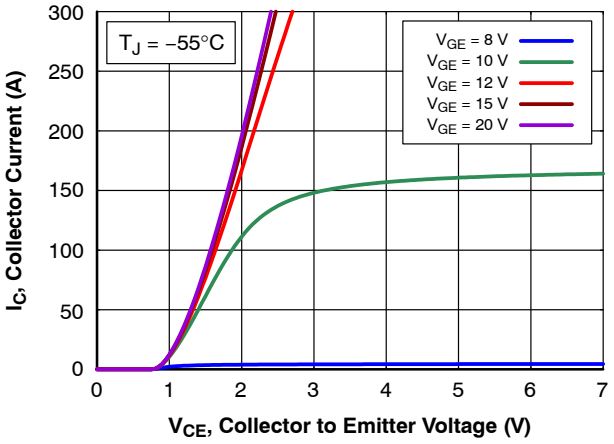



**Figure 1. Output Characteristics**

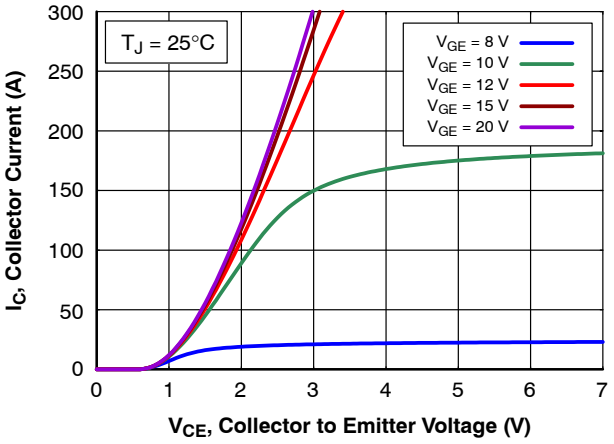



**Figure 2. Output Characteristics**

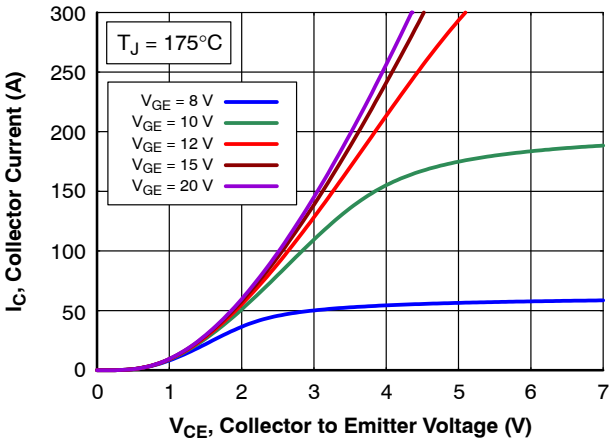



**Figure 3. Output Characteristics**

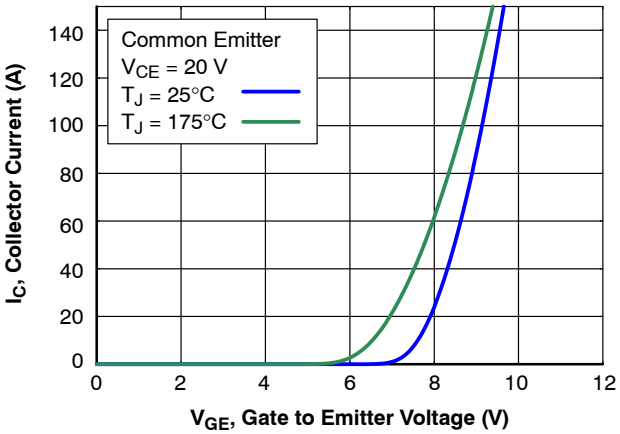



**Figure 4. Transfer Characteristics**

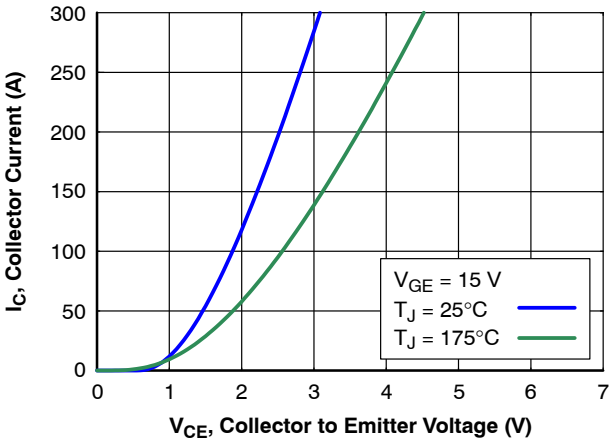



**Figure 5. Saturation Voltage Characteristics**

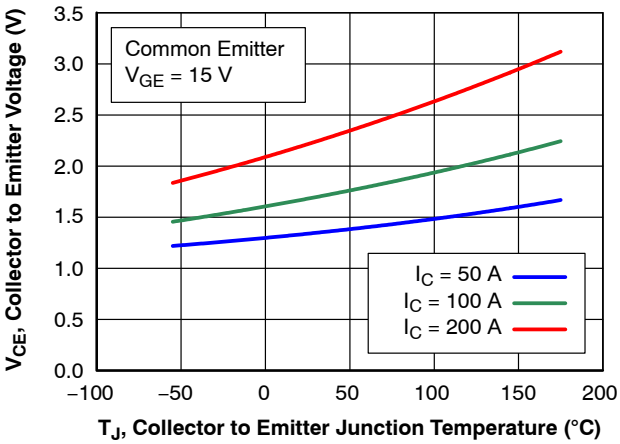



**Figure 6. Saturation Voltage vs Junction Temperature**

## TYPICAL CHARACTERISTICS (CONTINUED)

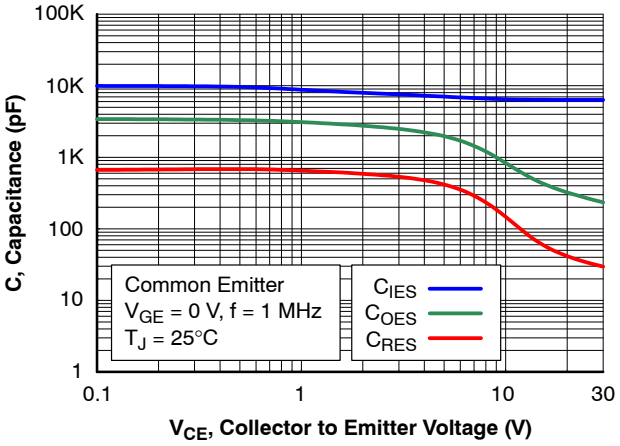



**Figure 7. Capacitance Characteristics**

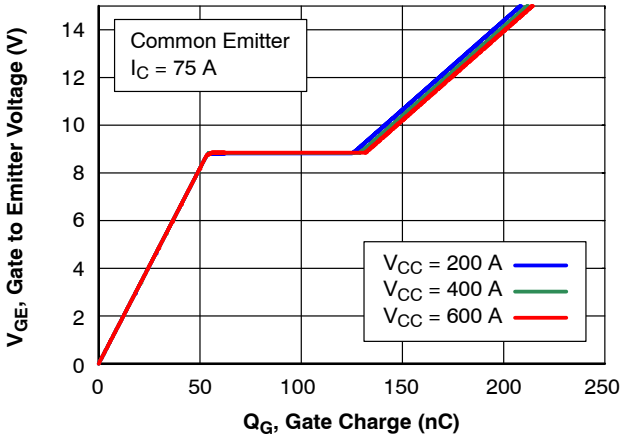



**Figure 8. Gate Charge Characteristics**

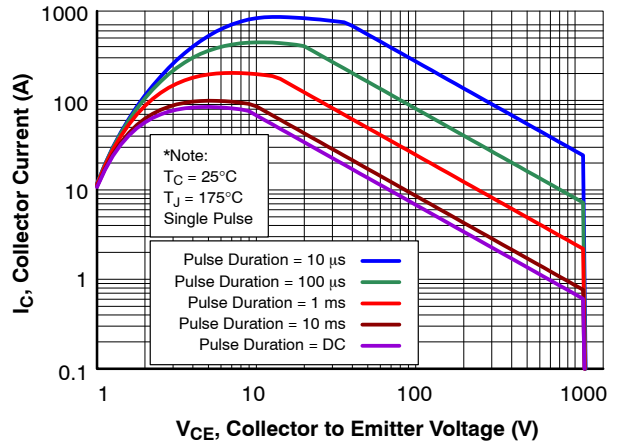



**Figure 9. SOA Characteristics**

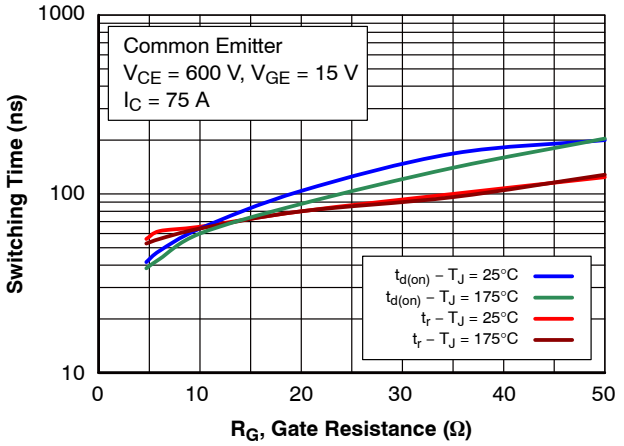



**Figure 10. Turn−On Time vs Gate Resistance**

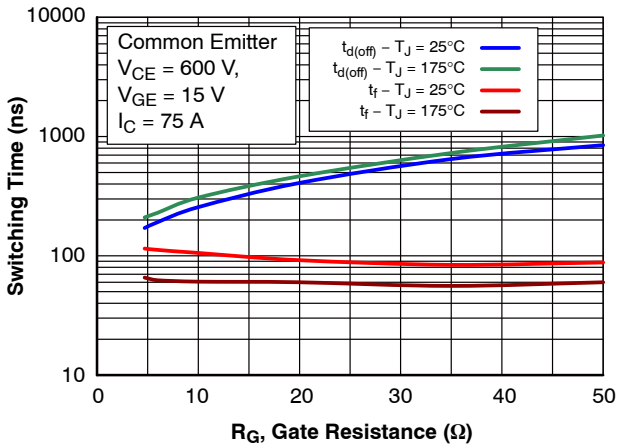



**Figure 11. Turn−Off Time vs Gate Resistance**

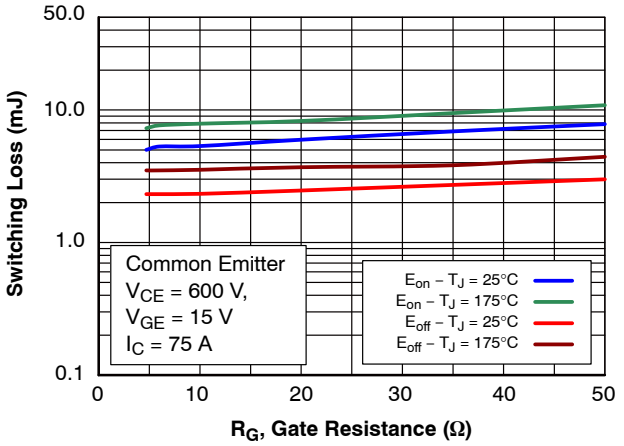



**Figure 12. Switching Loss vs Gate Resistance**

## TYPICAL CHARACTERISTICS (CONTINUED)

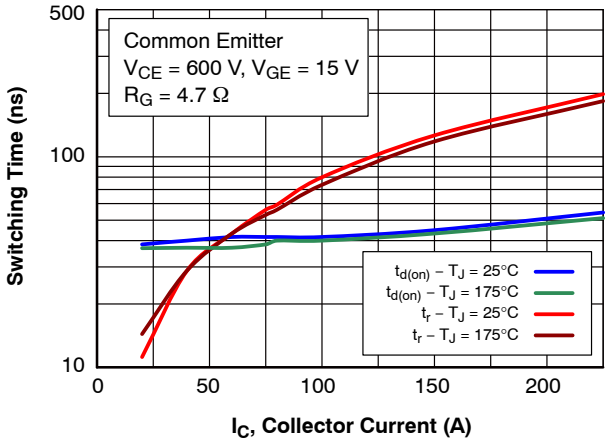



**Figure 13. Turn−On Time vs Collector Current**

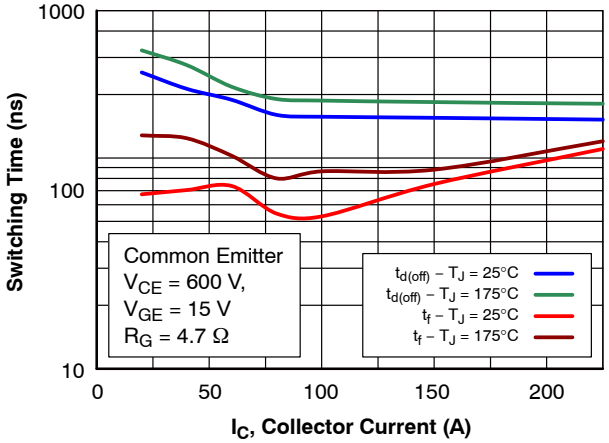



**Figure 14. Turn−Off Time vs Collector Current**

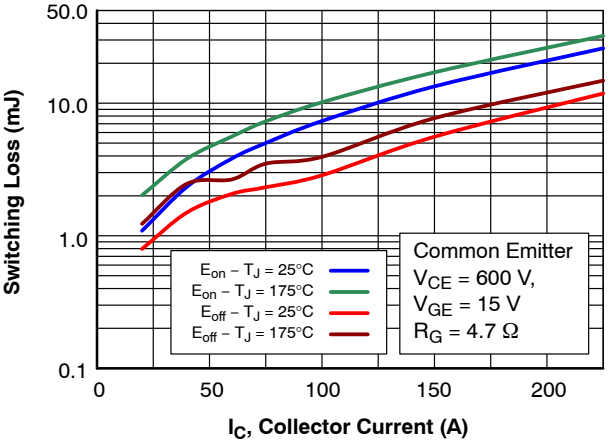



**Figure 15. Switching Loss vs Collector Current**

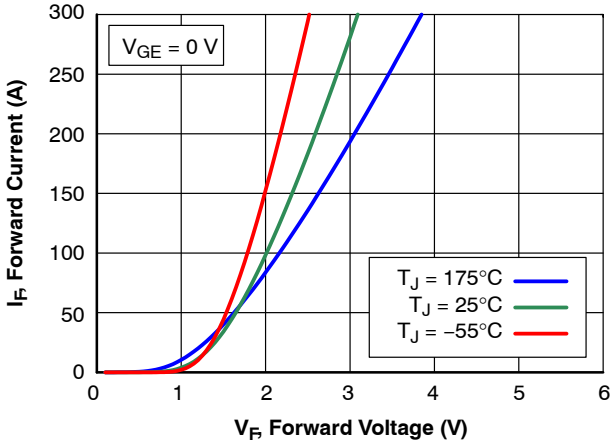



**Figure 16. Diode Forward Characteristics**

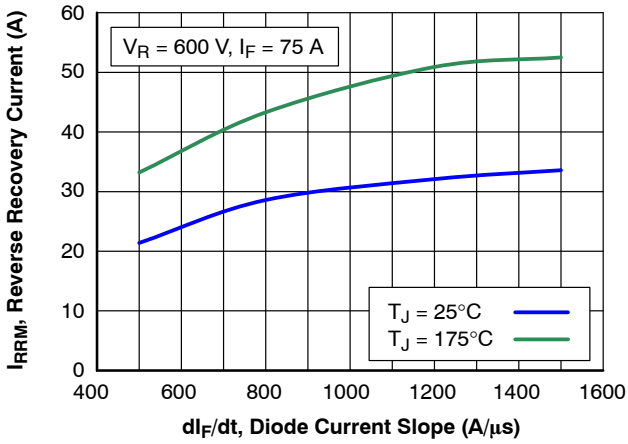



**Figure 17. Diode Reverse Recovery Current**

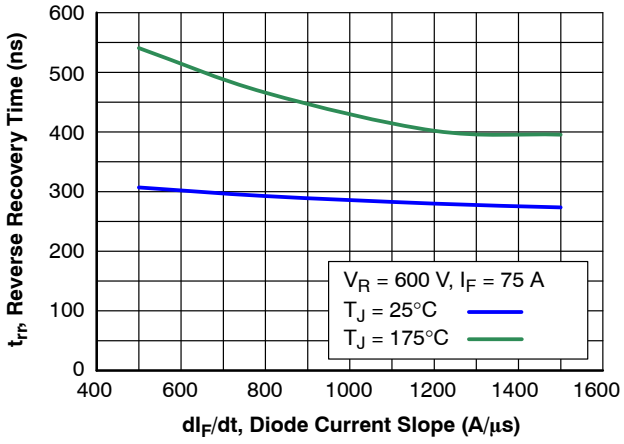



**Figure 18. Diode Reverse Recovery Time**

## TYPICAL CHARACTERISTICS (CONTINUED)

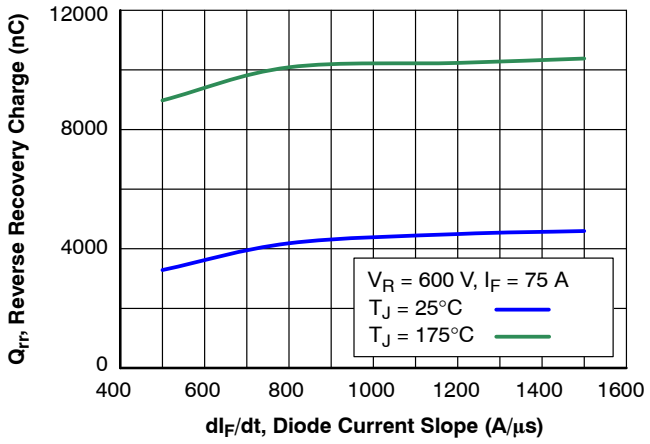



**Figure 19. Diode Stored Charge Characteristics**

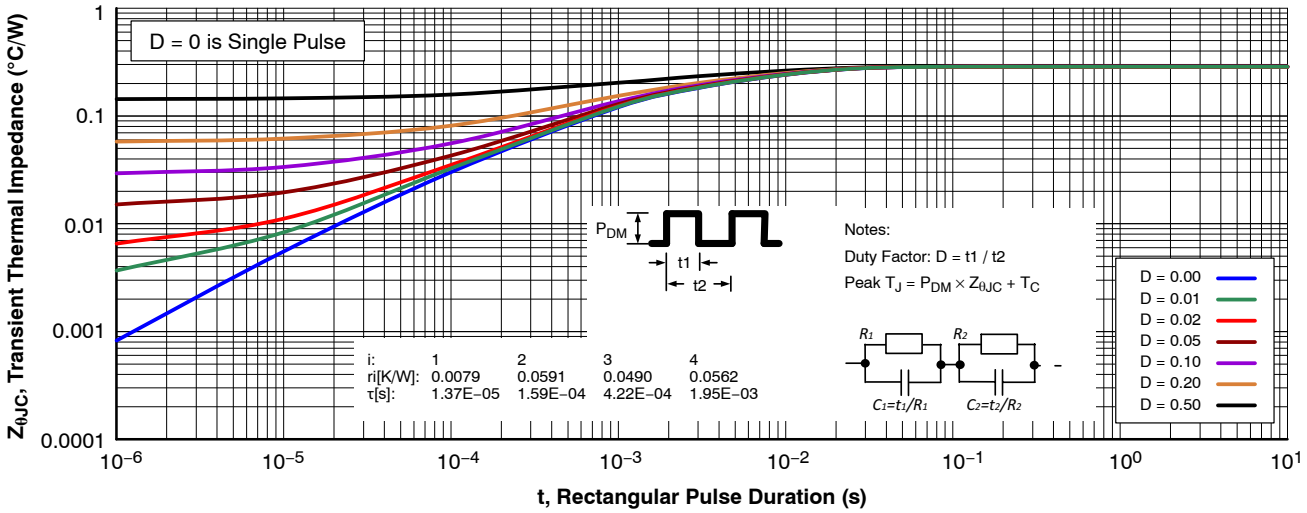



**Figure 20. Transient Thermal Impedance of IGBT**

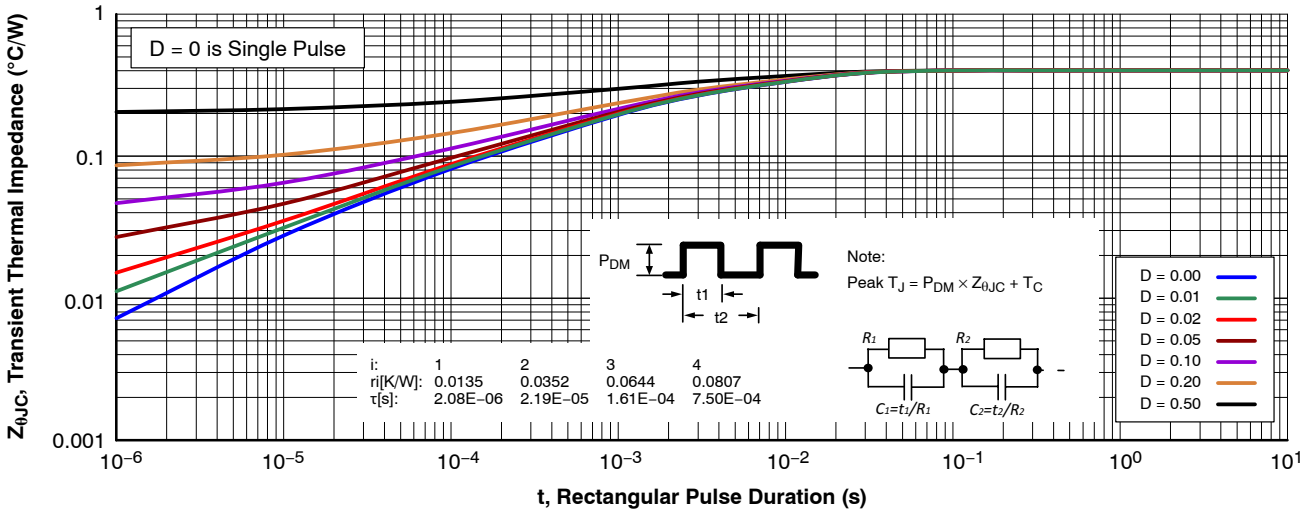
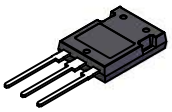



**Figure 21. Transient Thermal Impedance of Diode**

# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

ON Semiconductor®

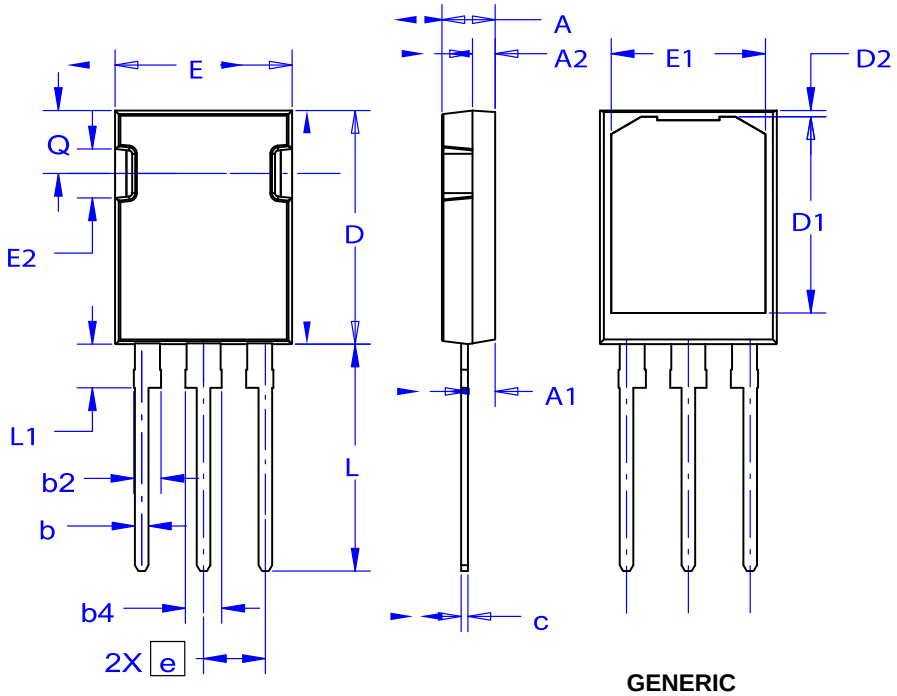


**TO−247−3LD**
CASE 340CD
ISSUE A

DATE 18 SEP 2018

NOTES:

A. THIS PACKAGE DOES NOT CONFORM TO ANY STANDARDS.
B. ALL DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
D. DIMENSION AND TOLERANCE AS PER ASME Y14.5-2009.




| DIM | MILLIMETERS | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 4.58 | 4.70 | 4.82 |
| A1 | 2.20 | 2.40 | 2.60 |
| A2 | 1.80 | 2.00 | 2.20 |
| D | 20.32 | 20.57 | 20.82 |
| E | 15.37 | 15.62 | 15.87 |
| E2 | 4.12 | 4.32 | 4.52 |
| e | ~ | 5.45 | ~ |
| L | 19.90 | 20.00 | 20.10 |
| L1 | 3.69 | 3.81 | 3.93 |
| Q | 5.34 | 5.46 | 5.58 |
| b | 1.10 | 1.20 | 1.30 |
| b2 | 2.10 | 2.24 | 2.39 |
| b4 | 2.87 | 3.04 | 3.20 |
| c | 0.51 | 0.61 | 0.71 |
| D1 | 16.63 | 16.83 | 17.03 |
| D2 | 0.51 | 0.93 | 1.35 |
| E1 | 13.40 | 13.60 | 13.80 |

**GENERIC MARKING DIAGRAM***


XXXX = 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. Some products may not follow the Generic Marking.

| | | |
|---|---|---|
| **DOCUMENT NUMBER:** | **98AON13857G** | 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−247−3LD** | **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