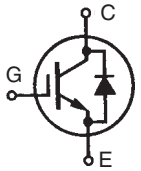
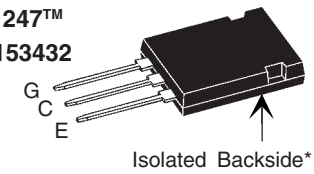
# NPT³ IGBT with Diode

in ISOPLUS 247™

$I_{C25}$ = 50 A
$V_{CES}$ = 1200 V
$V_{CE(sat)\,typ.}$ = 2.2 V




**ISOPLUS 247™**
E153432




G = Gate C = Collector E = Emitter

*Patent pending

## IGBT

| Symbol | Conditions | Maximum Ratings | |
|---|---|---|---|
| $V_{CES}$ | $T_{VJ}$ = 25°C to 150°C | 1200 | V |
| $V_{GES}$ | | ± 20 | V |
| $I_{C25}$ | $T_C$ = 25°C | 50 | A |
| $I_{C90}$ | $T_C$ = 90°C | 32 | A |
| $I_{CM}$ | $V_{GE}$ = ±15 V; $R_G$ = 39 Ω; $T_{VJ}$ = 125°C | 50 | A |
| $V_{CEK}$ | RBSOA, Clamped inductive load; L = 100 µH | $V_{CES}$ | |
| $t_{SC}$ (SCSOA) | $V_{CE}$ = 900V; $V_{GE}$ = ±15 V; $R_G$ = 39 Ω; $T_{VJ}$ = 125°C non-repetitive | 10 | µs |
| $P_{tot}$ | $T_C$ = 25°C | 200 | W |

| Symbol | Conditions | Characteristic Values ($T_{VJ}$ = 25°C, unless otherwise specified) min. | typ. | max. | |
|---|---|---|---|---|---|
| $V_{CE(sat)}$ | $I_C$ = 35 A; $V_{GE}$ = 15 V; $T_{VJ}$ = 25°C | | 2.2 | 2.8 | V |
| | $T_{VJ}$ = 125°C | | 2.6 | | V |
| $V_{GE(th)}$ | $I_C$ = 1 mA; $V_{GE}$ = $V_{CE}$ | 4.5 | | 6.5 | V |
| $I_{CES}$ | $V_{CE}$ = $V_{CES}$; $V_{GE}$ = 0 V; $T_{VJ}$ = 25°C | | | 0.4 | mA |
| | $T_{VJ}$ = 125°C | | 0.4 | | mA |
| $I_{GES}$ | $V_{CE}$ = 0 V; $V_{GE}$ = ± 20 V | | | 200 | nA |
| $t_{d(on)}$ | Inductive load, $T_{VJ}$ = 125°C | | 85 | | ns |
| $t_r$ | $V_{CE}$ = 600 V; $I_C$ = 35 A | | 50 | | ns |
| $t_{d(off)}$ | $V_{GE}$ = ±15 V; $R_G$ = 39 Ω | | 440 | | ns |
| $t_f$ | | | 50 | | ns |
| $E_{on}$ | | | 5.4 | | mJ |
| $E_{off}$ | | | 2.6 | | mJ |
| $C_{ies}$ | $V_{CE}$ = 25 V; $V_{GE}$ = 0 V; f = 1 MHz | | 2 | | nF |
| $Q_{Gon}$ | $V_{CE}$ = 600 V; $V_{GE}$ = 15 V; $I_C$ = 35 A | | 150 | | nC |
| $R_{thJC}$ | | | | 0.6 | K/W |
| $R_{thCH}$ | with heatsink compound | | 0.3 | | K/W |

### Features

- NPT³ IGBT
  - low saturation voltage
  - positive temperature coefficient for easy paralleling
  - fast switching
  - short tail current for optimized performance in resonant circuits
- HiPerFRED™ diode
  - fast reverse recovery
  - low operating forward voltage
  - low leakage current
- ISOPLUS 247™ package
  - isolated back surface
  - low coupling capacity between pins and heatsink
  - high reliability
  - industry standard outline

### Applications

- single switches
- choppers with complementary free wheeling diodes
- phaselegs, H bridges, three phase bridges e.g. for
  - power supplies, UPS
  - AC, DC and SR drives
  - induction heating

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## Diode

| Symbol | Conditions | Maximum Ratings | |
|---|---|---|---|
| $I_{F25}$ | $T_C$ = 25°C | 48 | A |
| $I_{F90}$ | $T_C$ = 90°C | 25 | A |

| Symbol | Conditions | Characteristic Values min. | typ. | max. | |
|---|---|---|---|---|---|
| $V_F$ | $I_F$ = 35 A; $T_{VJ}$ = 25°C | | 2.5 | 2.9 | V |
| | $T_{VJ}$ = 125°C | | 1.9 | | V |
| $I_{RM}$ | $I_F$ = 30 A; $di_F/dt$ = -1100 A/µs; $T_{VJ}$ = 125°C | | 51 | | A |
| $t_{rr}$ | $V_R$ = 600 V; $V_{GE}$ = 0 V | | 80 | | ns |
| $E_{rec(off)}$ | | | 1.8 | | mJ |
| $R_{thJC}$ | | | | 1.2 | K/W |
| $R_{thCH}$ | with heatsink compound | | 0.6 | | K/W |

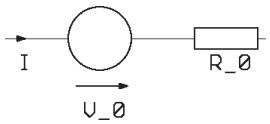
## Component

| Symbol | Conditions | Maximum Ratings | |
|---|---|---|---|
| $T_{VJ}$ | | -55...+150 | °C |
| $T_{stg}$ | | -55...+125 | °C |
| $V_{ISOL}$ | $I_{ISOL} \leq$ 1 mA; 50/60 Hz | 2500 | V~ |
| $F_C$ | mounting force with clip | 20...120 | N |

| Symbol | Conditions | Characteristic Values min. | typ. | max. | |
|---|---|---|---|---|---|
| $C_p$ | coupling capacity between shorted pins and mounting tab in the case | | 30 | | pF |
| **Weight** | | | 6 | | g |

### Equivalent Circuits for Simulation

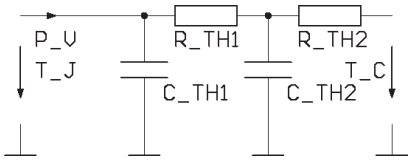
**Conduction**




IGBT (typ. at $V_{GE}$ = 15 V; $T_J$ = 125°C)
*$V_0$ = 0.95 V; $R_0$ = 45 mΩ*

Diode (typ. at $T_J$ = 125°C)
*$V_0$ = 1.26V; $R_0$ = 15 mΩ*

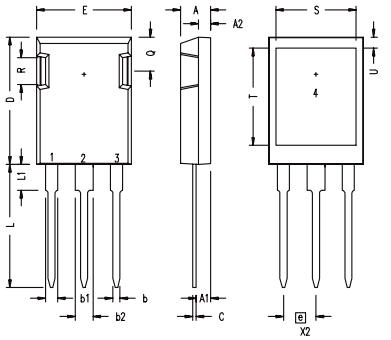
**Thermal Response**




IGBT
*$C_{th1}$ = 0.067 J/K; $R_{th1}$ = 0.108 K/W*
*$C_{th2}$ = 0.175 J/K; $R_{th2}$ = 0.491 K/W*

Diode
*$C_{th1}$ = 0.039 J/K; $R_{th1}$ = 0.311 K/W*
*$C_{th2}$ = 0.090 J/K; $R_{th2}$ = 0.889 K/W*

### ISOPLUS 247 OUTLINE




1 Gate, 2 Drain (Collector)
3 Source (Emitter)
4 no connection

| Dim. | Millimeter Min. | Max. | Inches Min. | Max. |
|---|---|---|---|---|
| A | 4.83 | 5.21 | .190 | .205 |
| $A_1$ | 2.29 | 2.54 | .090 | .100 |
| $A_2$ | 1.91 | 2.16 | .075 | .085 |
| b | 1.14 | 1.40 | .045 | .055 |
| $b_1$ | 1.91 | 2.13 | .075 | .084 |
| $b_2$ | 2.92 | 3.12 | .115 | .123 |
| C | 0.61 | 0.80 | .024 | .031 |
| D | 20.80 | 21.34 | .819 | .840 |
| E | 15.75 | 16.13 | .620 | .635 |
| e | 5.45 BSC | | .215 BSC | |
| L | 19.81 | 20.32 | .780 | .800 |
| L1 | 3.81 | 4.32 | .150 | .170 |
| Q | 5.59 | 6.20 | .220 | .244 |
| R | 4.32 | 4.83 | .170 | .190 |
| S | 13.21 | 13.72 | .520 | .540 |
| T | 15.75 | 16.26 | .620 | .640 |
| U | 1.65 | 3.03 | .065 | .080 |

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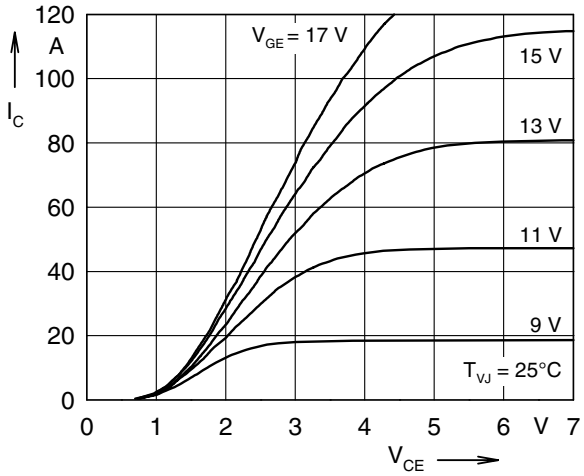


Fig. 1 Typ. output characteristics

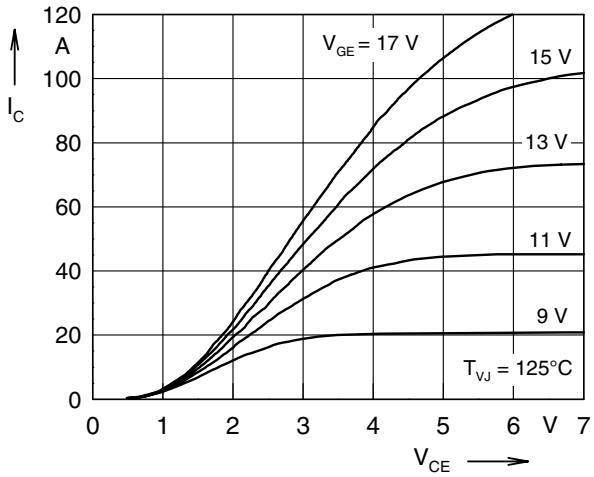


Fig. 2 Typ. output characteristics

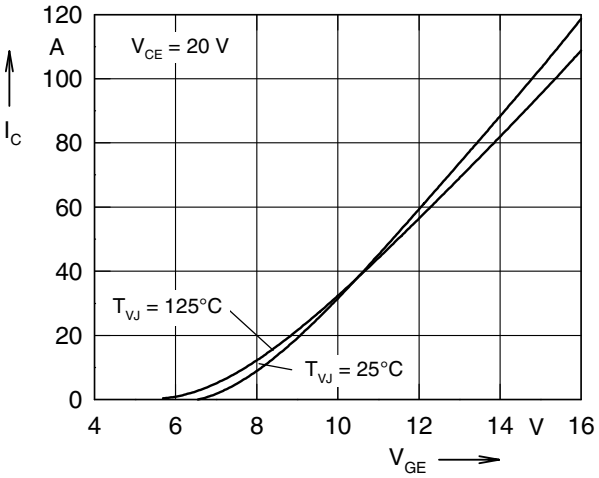


Fig. 3 Typ. transfer characteristics

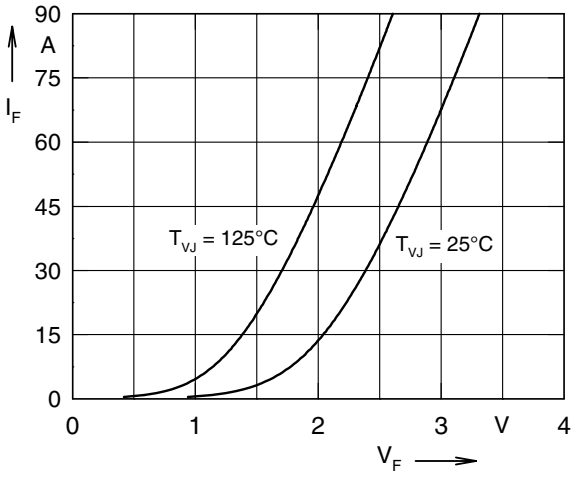


Fig. 4 Typ. forward characteristics of free wheeling diode

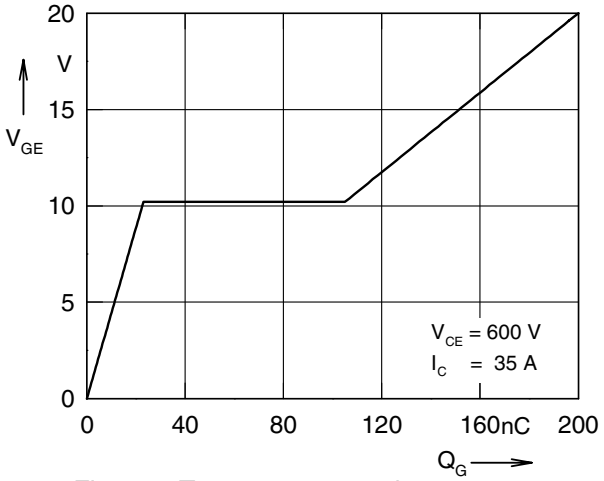


Fig. 5 Typ. turn on gate charge

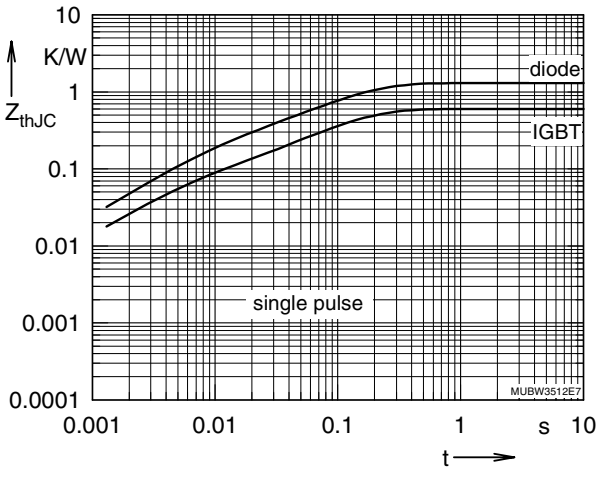


Fig. 6 Typ. transient thermal impedance

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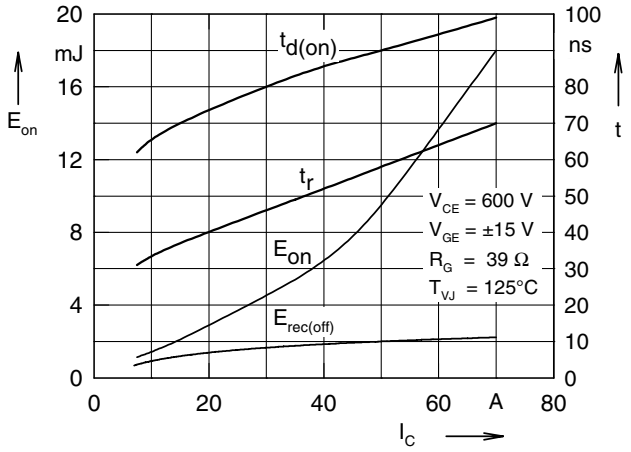


Fig. 7 Typ. turn on energy and switching times versus collector current

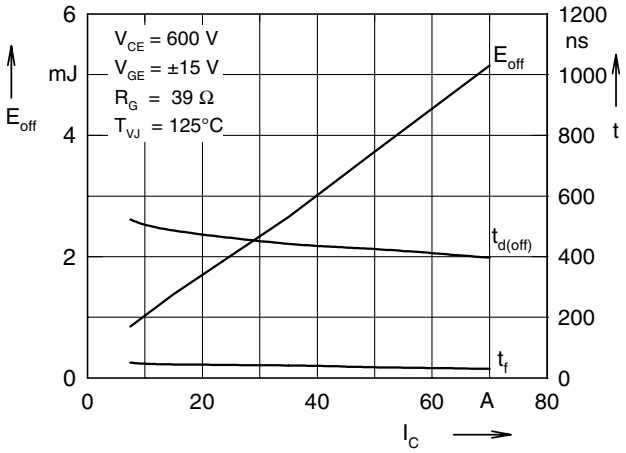


Fig. 8 Typ. turn off energy and switching times versus collector current

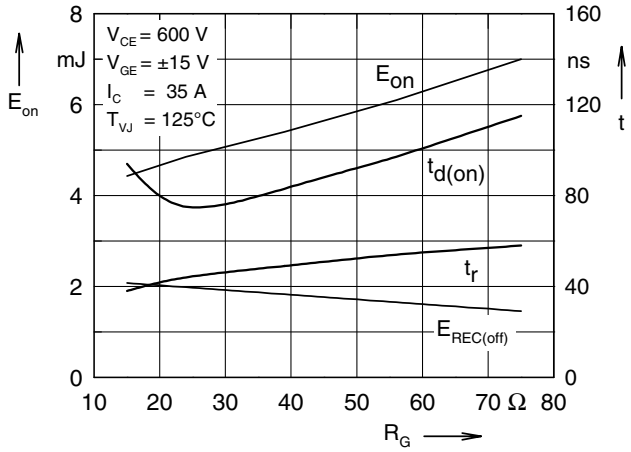


Fig. 9 Typ. turn on energy and switching times versus gate resistor

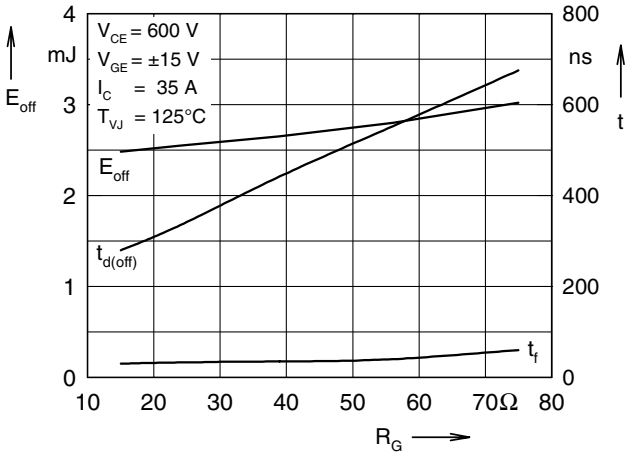


Fig.10 Typ. turn off energy and switching times versus gate resistor

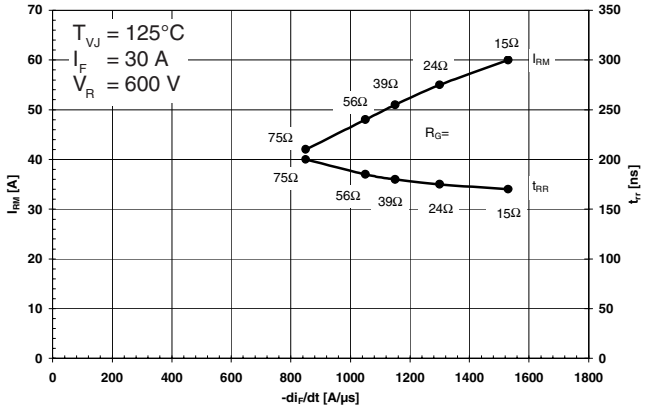


Fig. 11 Typ. turn off characteristics of free wheeling diode

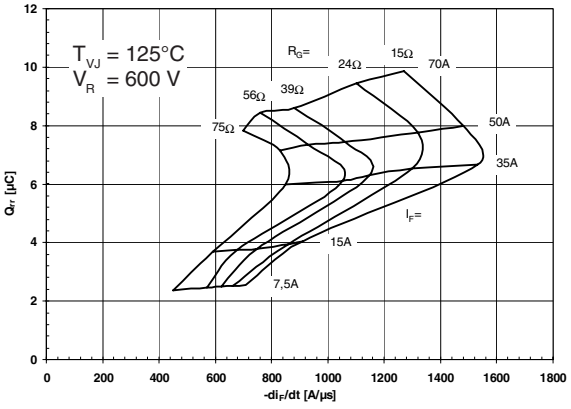


Fig. 12 Typ. turn off characteristics of free wheeling diode

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