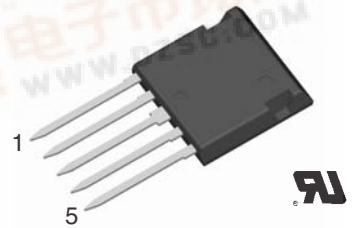
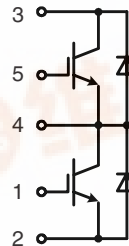


# NPT<sup>3</sup> IGBT

Phaseleg Topology  
in ISOPLUS i4-PAC™

**I<sub>C25</sub> = 33 A**  
**V<sub>CEs</sub> = 1200 V**  
**V<sub>CE(sat)</sub> typ = 2.4 V**



| IGBTs                               |  |                       |
|-------------------------------------|--|-----------------------|
| Symbol                              | Conditions   | Maximum Ratings       |
| V <sub>CEs</sub>                    | T <sub>VJ</sub> = 25°C to 150°C  | 1200 V                |
| V <sub>GES</sub>                    |  | ± 20 V                |
| I <sub>C25</sub>                    | T <sub>C</sub> = 25°C  | 33 A                  |
| I <sub>C90</sub>                    | T <sub>C</sub> = 90°C  | 20 A                  |
| I <sub>CM</sub><br>V <sub>CEK</sub> | V <sub>GE</sub> = ±15 V; R <sub>G</sub> = 68 Ω; T <sub>VJ</sub> = 125°C<br>RBSOA, Clamped inductive load; L = 100 μH | 40 V <sub>CEs</sub> A |
| t <sub>SC</sub><br>(SCSOA)          | V <sub>CE</sub> = 900V; V <sub>GE</sub> = ±15 V; R <sub>G</sub> = 68 Ω; T <sub>VJ</sub> = 125°C<br>non-repetitive    | 10 μs                 |
| P <sub>tot</sub>                    | T <sub>C</sub> = 25°C  | 150 W                 |

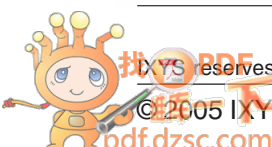
### Features

- NPT<sup>3</sup> IGBT
  - positive temperature coefficient of saturation voltage 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 i4-PAC™ package
  - isolated back surface
  - low coupling capacity between pins and heatsink
  - enlarged creepage towards heatsink
  - application friendly pinout
  - low inductive current path
  - high reliability
  - industry standard outline
  - UL registered, E 72873

| Symbol   | Conditions  | Characteristic Values<br>(T <sub>VJ</sub> = 25°C, unless otherwise specified) |  |                                  |        |
|--|---|---|--|----------------------------------|--------|
|  |   | min.  | typ.                                   | max.                             |        |
| V <sub>CE(sat)</sub>   | I <sub>C</sub> = 20 A; V <sub>GE</sub> = 15 V; T <sub>VJ</sub> = 25°C<br>T <sub>VJ</sub> = 125°C  |   | 2.4<br>2.8                             | V<br>V                           |        |
| V <sub>GE(th)</sub>  | I <sub>C</sub> = 0.6 mA; V <sub>GE</sub> = V <sub>CE</sub>  | 4.5   |  | V                                |        |
| I <sub>CES</sub>   | V <sub>CE</sub> = V <sub>CEs</sub> ; V <sub>GE</sub> = 0 V; T <sub>VJ</sub> = 25°C<br>T <sub>VJ</sub> = 125°C                               |   | 0.2                                    | 0.2 mA<br>mA                     |        |
| I <sub>GES</sub>   | V <sub>CE</sub> = 0 V; V <sub>GE</sub> = ± 20 V   |   |  | 200 nA                           |        |
| t <sub>d(on)</sub><br>t <sub>r</sub><br>t <sub>d(off)</sub><br>t <sub>f</sub><br>E <sub>on</sub><br>E <sub>off</sub> | Inductive load, T <sub>VJ</sub> = 125°C<br>V <sub>CE</sub> = 600 V; I <sub>C</sub> = 20 A<br>V <sub>GE</sub> = ±15 V; R <sub>G</sub> = 68 Ω |   | 205<br>105<br>320<br>175<br>4.1<br>1.5 | ns<br>ns<br>ns<br>ns<br>mJ<br>mJ |        |
| C <sub>ies</sub>   |   | V <sub>CE</sub> = 25 V; V <sub>GE</sub> = 0 V; f = 1 MHz                      | 1.2                                    |                                  | nF     |
| Q <sub>Gon</sub>   |   | V <sub>CE</sub> = 600 V; V <sub>GE</sub> = 15 V; I <sub>C</sub> = 20 A        | 100                                    |                                  | nC     |
| R <sub>thJC</sub>  |   |   |  |                                  | 0.8 KW |
| R <sub>thJH</sub>  |   | with heat transfer paste  |  | 1.2                              | KW     |

### Applications

- single phaseleg
  - buck-boost chopper
- H bridge
  - power supplies
  - induction heating
  - four quadrant DC drives
  - controlled rectifier
- three phase bridge
  - AC drives
  - controlled rectifier



## Diodes

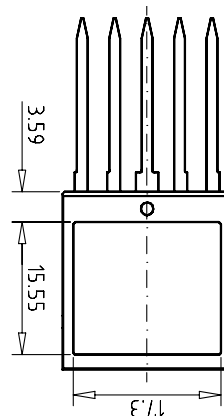
| Symbol    | Conditions               | Maximum Ratings |   |
|-----------|--------------------------|-----------------|---|
| $I_{F25}$ | $T_C = 25^\circ\text{C}$ | 25              | A |
| $I_{F90}$ | $T_C = 90^\circ\text{C}$ | 15              | A |

| Symbol                   | Conditions  | Characteristic Values |      |                |
|--------------------------|---|-----------------------|------|----------------|
|                          |   | min.                  | typ. | max.           |
| $V_F$                    | $I_F = 20\text{ A}; T_{VJ} = 25^\circ\text{C}$<br>$T_{VJ} = 125^\circ\text{C}$  | 2.5<br>1.9            | 3.0  | V<br>V         |
| $I_{RM}$<br>$t_{rr}$     | } $I_F = 15\text{ A}; di_F/dt = -400\text{ A}/\mu\text{s}; T_{VJ} = 125^\circ\text{C}$<br>$V_R = 600\text{ V}; V_{GE} = 0\text{ V}$ | 16                    |      | A              |
|                          |   | 130                   |      | ns             |
| $R_{thJC}$<br>$R_{thCH}$ | (per diode)<br>with heat transfer paste   | 3.6                   |      | 2.3 K/W<br>K/W |

## Component

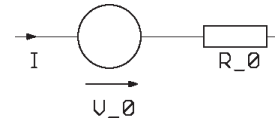
| Symbol     | Conditions                                   | Maximum Ratings |                  |
|------------|--|-----------------|------------------|
| $T_{VJ}$   |  | -55...+150      | $^\circ\text{C}$ |
| $T_{stg}$  |  | -55...+125      | $^\circ\text{C}$ |
| $V_{ISOL}$ | $I_{ISOL} \leq 1\text{ mA}; 50/60\text{ Hz}$ | 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 |                       | 40   | pF   |
| $d_S, d_A$ | pin - pin   | 1.7                   |      | mm   |
| $d_S, d_A$ | pin - backside metal  | 5.5                   |      | mm   |
| Weight     |   |                       | 9    | g    |



## Equivalent Circuits for Simulation

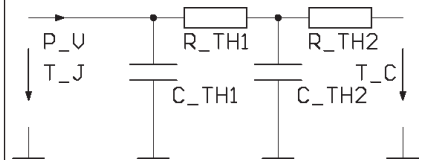
### Conduction



IGBT (typ. at  $V_{GE} = 15\text{ V}; T_J = 125^\circ\text{C}$ )  
 $V_o = 1.09\text{ V}; R_o = 85\text{ m}\Omega$

Free Wheeling Diode (typ. at  $T_J = 125^\circ\text{C}$ )  
 $V_o = 1.3\text{ V}; R_o = 32\text{ m}\Omega$

### Thermal Response



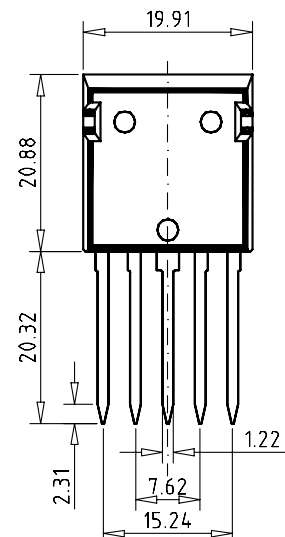
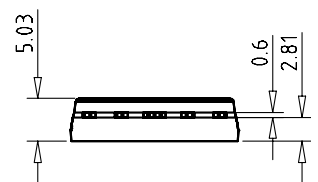
IGBT (typ.)

$C_{th1} = 0.049\text{ J/K}; R_{th1} = 0.15\text{ K/W}$   
 $C_{th2} = 0.133\text{ J/K}; R_{th2} = 0.65\text{ K/W}$

Free Wheeling Diode (typ.)

$C_{th1} = 0.021\text{ J/K}; R_{th1} = 0.63\text{ K/W}$   
 $C_{th2} = 0.052\text{ J/K}; R_{th2} = 1.67\text{ K/W}$

## Dimensions in mm (1 mm = 0.0394")



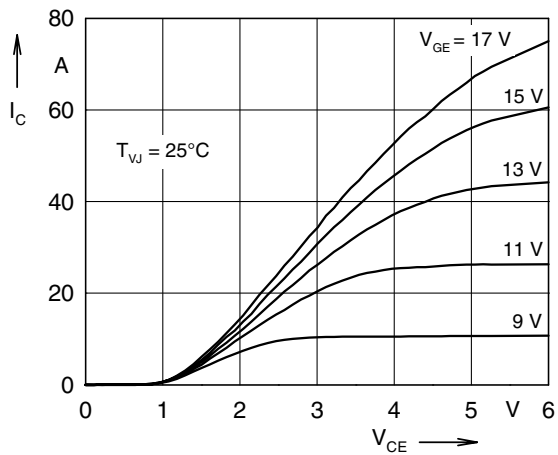


Fig. 1 Typ. output characteristics

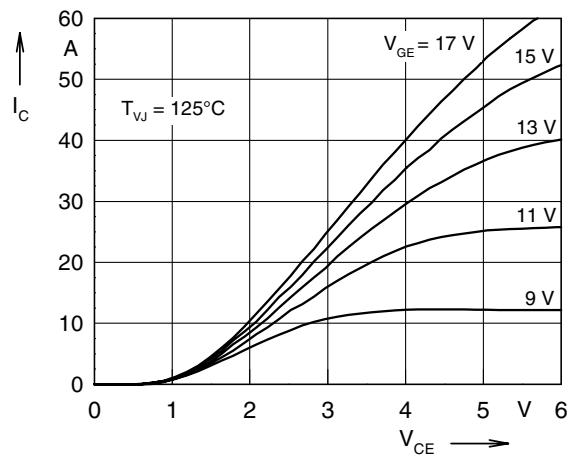


Fig. 2 Typ. output characteristics

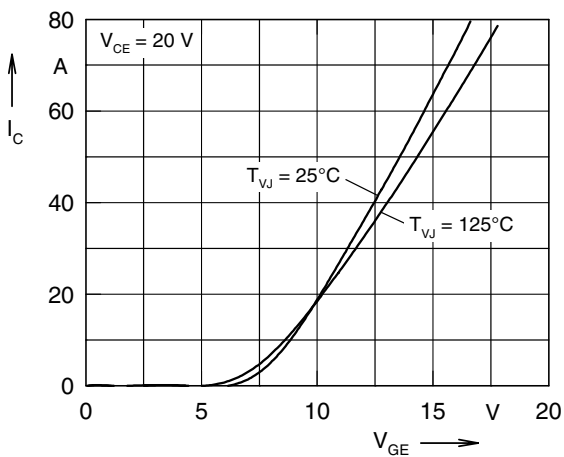


Fig. 3 Typ. transfer characteristics

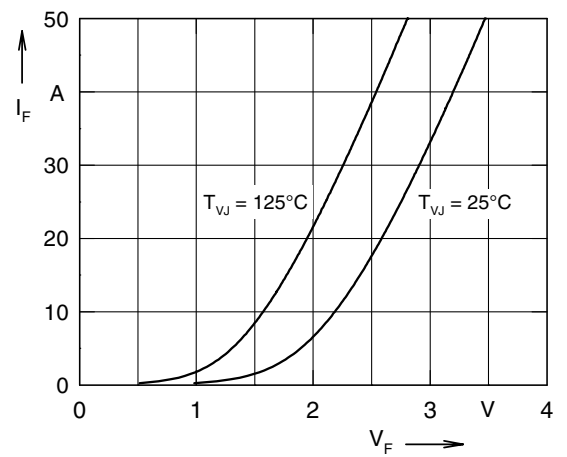


Fig. 4 Typ. forward characteristics of free wheeling diode

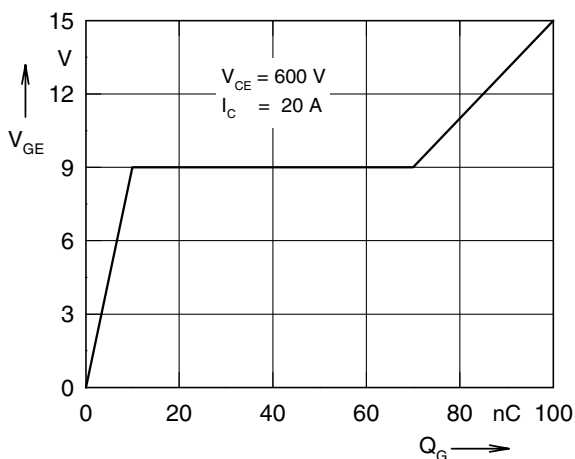


Fig. 5 Typ. turn on gate charge

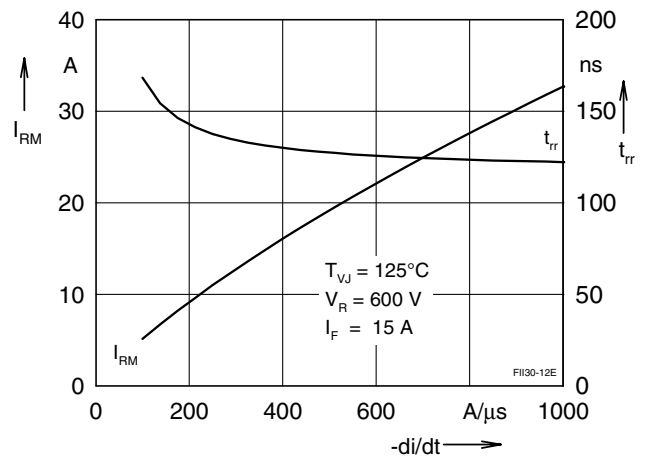


Fig. 6 Typ. turn off characteristics of free wheeling diode

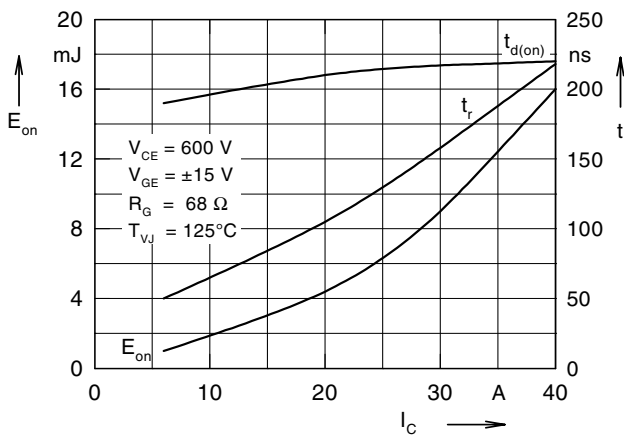


Fig. 7 Typ. turn on energy and switching times versus collector current

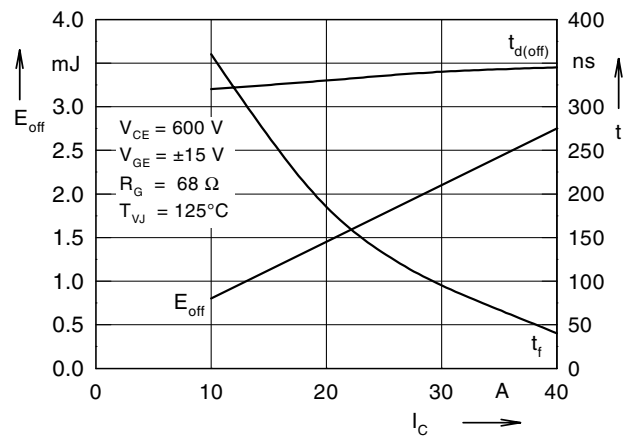


Fig. 8 Typ. turn off energy and switching times versus collector current

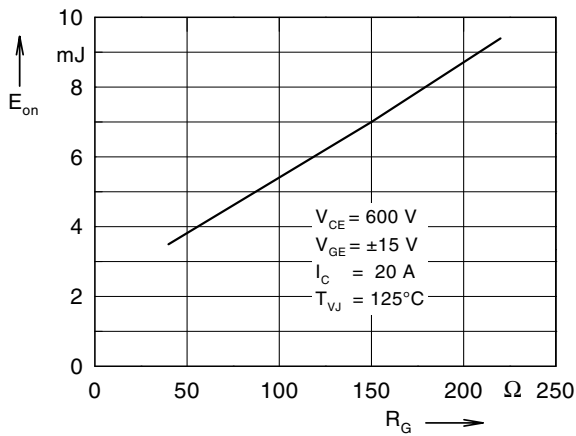


Fig. 9 Typ. turn on energy vs gate resistor

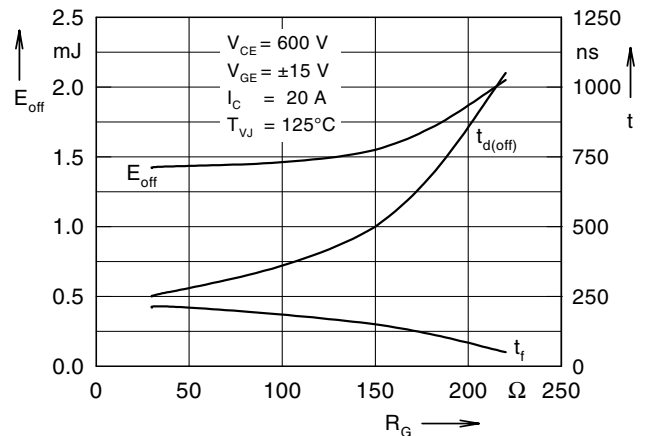


Fig. 10 Typ. turn off energy and switching times versus gate resistor

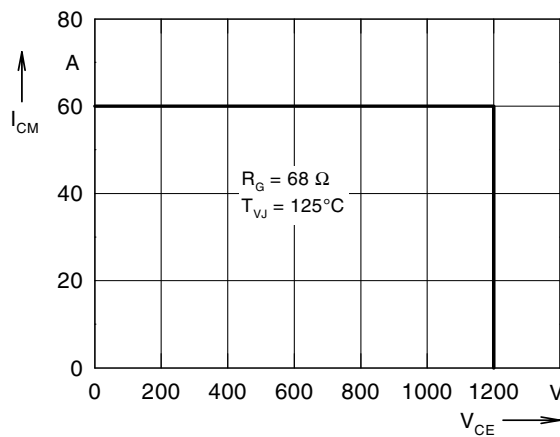


Fig. 11 Reverse biased safe operating area RBSOA

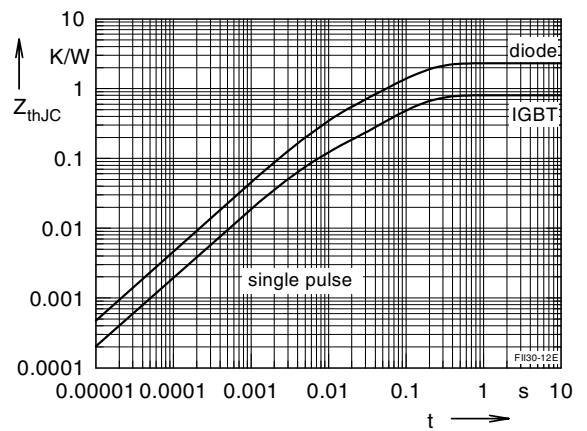


Fig. 12 Typ. transient thermal impedance