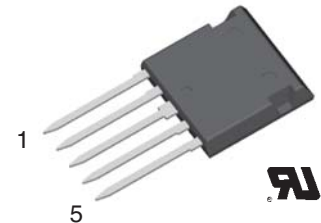
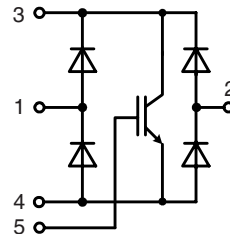


# Bidirectional Switch with NPT<sup>3</sup> IGBT and fast Diode Bridge in ISOPLUS i4-PAC™

$I_{C25} = 50 \text{ A}$   
 $V_{CES} = 1200 \text{ V}$   
 $V_{CE(sat) \text{ typ.}} = 2.0 \text{ V}$



## IGBT

| Symbol                | Conditions   | Maximum Ratings |               |
|-----------------------|--|-----------------|---------------|
| $V_{CES}$             | $T_{VJ} = 25^{\circ}\text{C to } 150^{\circ}\text{C}$  | 1200            | V             |
| $V_{GES}$             |  | $\pm 20$        | V             |
| $I_{C25}$             | $T_C = 25^{\circ}\text{C}$   | 50              | A             |
| $I_{C90}$             | $T_C = 90^{\circ}\text{C}$   | 32              | A             |
| $I_{CM}$<br>$V_{CEK}$ | $V_{GE} = \pm 15 \text{ V}; R_G = 39 \Omega; T_{VJ} = 125^{\circ}\text{C}$<br>RBSOA, Clamped inductive load; $L = 100 \mu\text{H}$ | 50              | A             |
|                       |  | $V_{CES}$       |               |
| $t_{SC}$<br>(SCSOA)   | $V_{CE} = 900\text{V}; V_{GE} = \pm 15 \text{ V}; R_G = 39 \Omega; T_{VJ} = 125^{\circ}\text{C}$<br>non-repetitive                 | 10              | $\mu\text{s}$ |
| $P_{tot}$             | $T_C = 25^{\circ}\text{C}$   | 200             | W             |

## Features

- NPT<sup>3</sup> IGBT
  - low saturation voltage
  - positive temperature coefficient for easy paralleling
  - fast switching
  - short tail current for optimized performance in resonant circuits
- HiPerFRED™ diodes
  - 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>( $T_{VJ} = 25^{\circ}\text{C}$ , unless otherwise specified) |      |          |
|--|--|--|------|----------|
|  |  | min.   | typ. | max.     |
| $V_{CE(sat)}$  | $I_C = 30 \text{ A}; V_{GE} = 15 \text{ V}; T_{VJ} = 25^{\circ}\text{C}$<br>$T_{VJ} = 125^{\circ}\text{C}$                                     | 2.0<br>2.3   | 2.6  | V<br>V   |
| $V_{GE(th)}$   | $I_C = 1 \text{ mA}; V_{GE} = V_{CE}$  | 4.5  | 6.5  | V        |
| $I_{CES}$  | $V_{CE} = V_{CES}; V_{GE} = 0 \text{ V}; T_{VJ} = 25^{\circ}\text{C}$<br>$T_{VJ} = 125^{\circ}\text{C}$  | 0.4  | 0.4  | mA<br>mA |
| $I_{GES}$  | $V_{CE} = 0 \text{ V}; V_{GE} = \pm 20 \text{ V}$  |  | 200  | nA       |
| $t_{d(on)}$<br>$t_r$<br>$t_{d(off)}$<br>$t_f$<br>$E_{on}$<br>$E_{off}$ | Inductive load, $T_{VJ} = 125^{\circ}\text{C}$<br>$V_{CE} = 600 \text{ V}; I_C = 30 \text{ A}$<br>$V_{GE} = \pm 15 \text{ V}; R_G = 39 \Omega$ | 85   |      | ns       |
|  |  | 50   |      | ns       |
|  |  | 440  |      | ns       |
|  |  | 50   |      | ns       |
|  |  | 4.6  |      | mJ       |
|  |  | 2.2  |      | mJ       |
| $C_{ies}$  | $V_{CE} = 25 \text{ V}; V_{GE} = 0 \text{ V}; f = 1 \text{ MHz}$   | 2  |      | nF       |
| $Q_{Gon}$  | $V_{CE} = 600 \text{ V}; V_{GE} = 15 \text{ V}; I_C = 35 \text{ A}$  | 150  |      | nC       |
| $R_{thJC}$<br>$R_{thJS}$   |  | 1.2  | 0.6  | KW<br>KW |

## Applications

- switches to control bidirectional current flow by a single control signal:
- matrix converters
  - spare matrix converters
  - AC controllers

**Diodes**

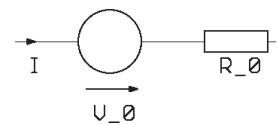
| Symbol    | Conditions               | Maximum Ratings |   |
|-----------|--------------------------|-----------------|---|
| $I_{F25}$ | $T_C = 25^\circ\text{C}$ | 48              | A |
| $I_{F90}$ | $T_C = 90^\circ\text{C}$ | 25              | A |

| Symbol                   | Conditions   | Characteristic Values |      |                |
|--------------------------|--|-----------------------|------|----------------|
|                          |  | min.                  | typ. | max.           |
| $V_F$                    | $I_F = 30\text{ A}; T_{VJ} = 25^\circ\text{C}$<br>$T_{VJ} = 125^\circ\text{C}$ | 2.4                   | 2.8  | V              |
|                          |  | 1.8                   |      | V              |
| $I_{RM}$<br>$t_{rr}$     |  | 27                    |      | A              |
|                          |  | 150                   |      | ns             |
| $R_{thJC}$<br>$R_{thJS}$ | (per diode)  | 1.6                   |      | 1.3 K/W<br>K/W |

**Component**

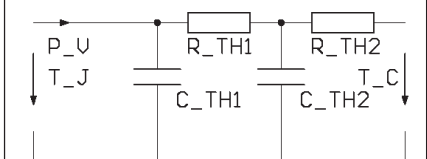
| Symbol     | Conditions                                   | Maximum Ratings |                  |
|------------|--|-----------------|------------------|
| $T_{VJ}$   |  | -55...+150      | $^\circ\text{C}$ |
| $T_{stg}$  |  | -55...+125      | $^\circ\text{C}$ |
| $V_{ISOL}$ | $I_{ISOL} \leq 1\text{ mA}; 50/60\text{ Hz}$ | 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  $V_{GE} = 15\text{ V}; T_J = 125^\circ\text{C}$ )  
 $V_0 = 0.95\text{ V}; R_0 = 45\text{ m}\Omega$

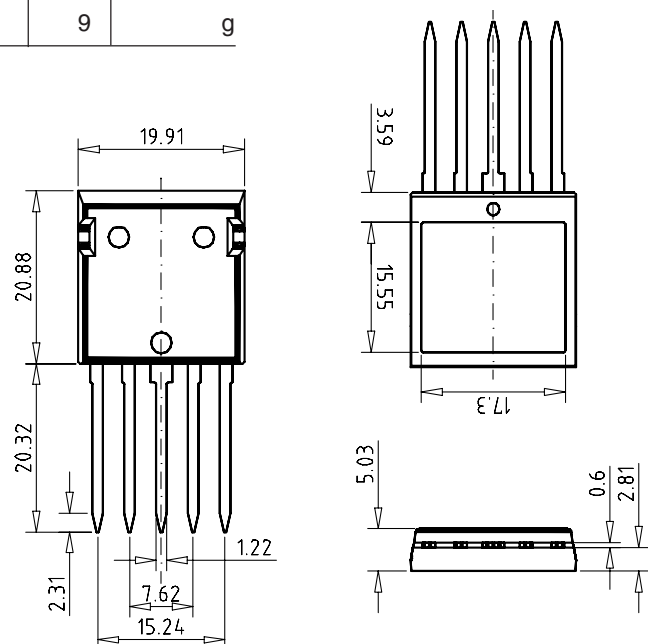
Diode (typ. at  $T_J = 125^\circ\text{C}$ )  
 $V_0 = 1.26\text{ V}; R_0 = 15\text{ m}\Omega$

**Thermal Response**

**IGBT**

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

**Diode**

$C_{th1} = 0.039\text{ J/K}; R_{th1} = 0.337\text{ K/W}$   
 $C_{th2} = 0.090\text{ J/K}; R_{th2} = 0.963\text{ K/W}$

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


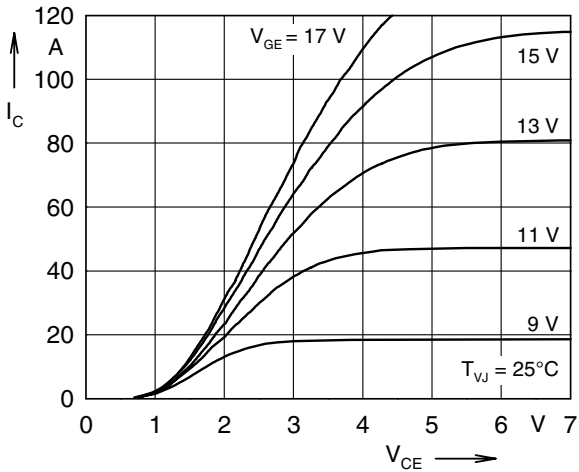


Fig. 1 Typ. output characteristics

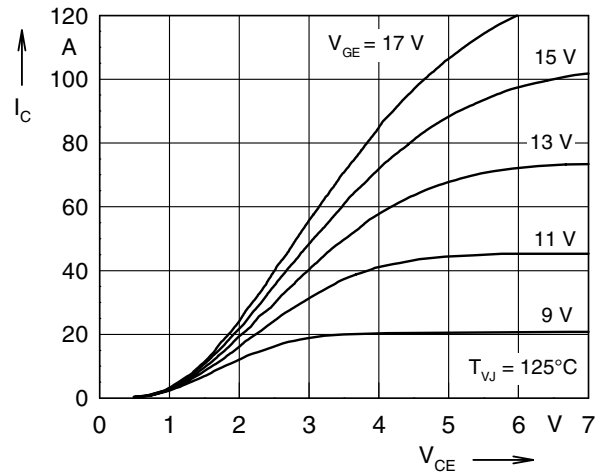


Fig. 2 Typ. output characteristics

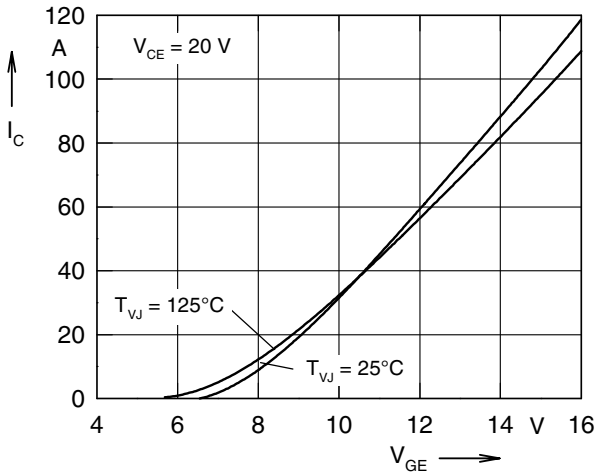


Fig. 3 Typ. transfer characteristics

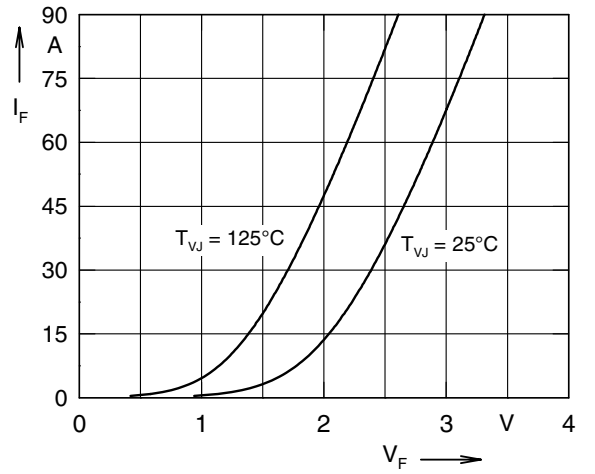


Fig. 4 Typ. forward characteristics of free wheeling diode

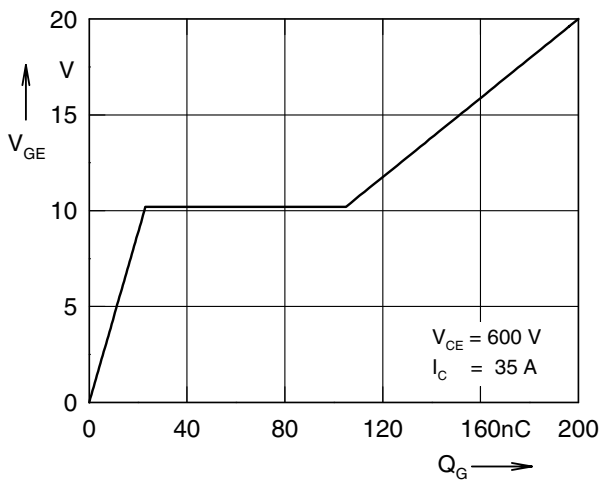


Fig. 5 Typ. turn on gate charge

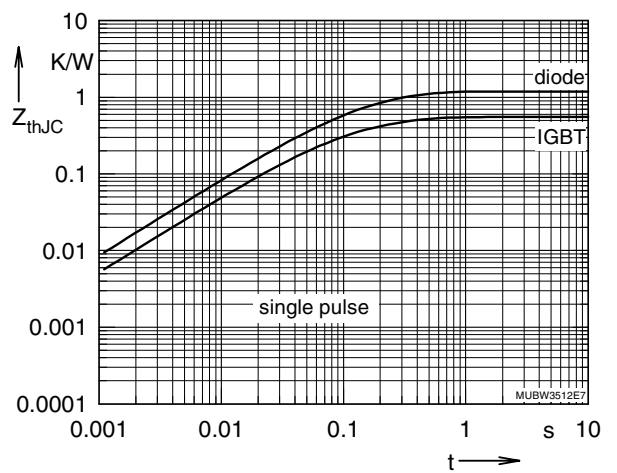


Fig. 6 Typ. transient thermal impedance

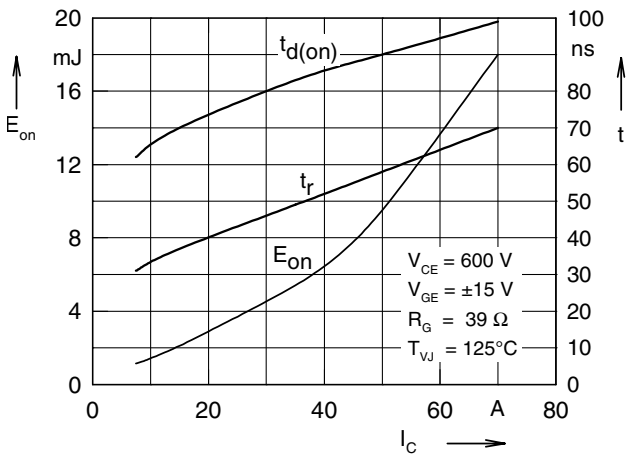


Fig. 7 Typ. turn on energy and switching times versus collector current

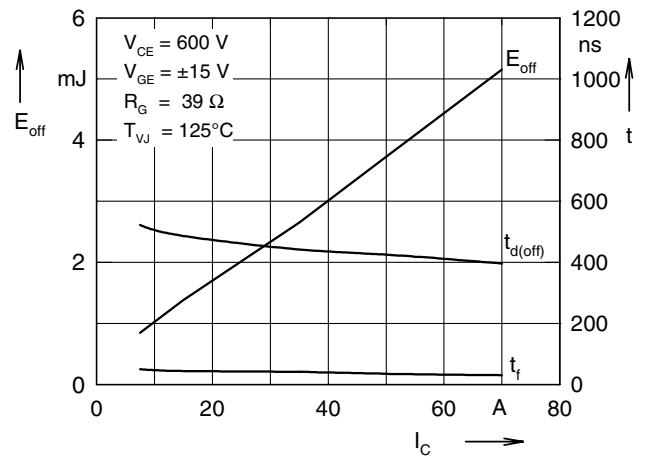


Fig. 8 Typ. turn off energy and switching times versus collector current

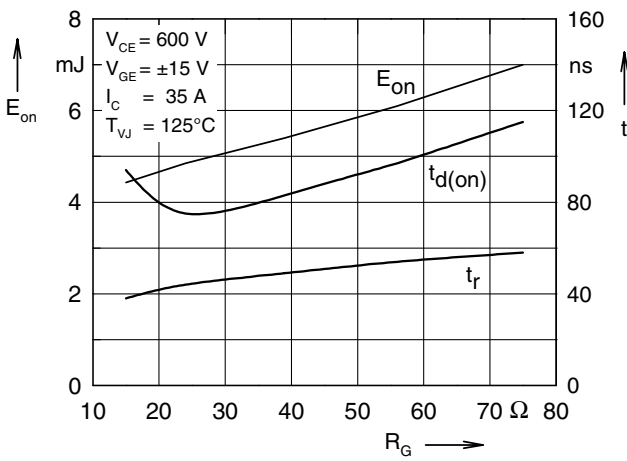


Fig. 9 Typ. turn on energy and switching times versus gate resistor

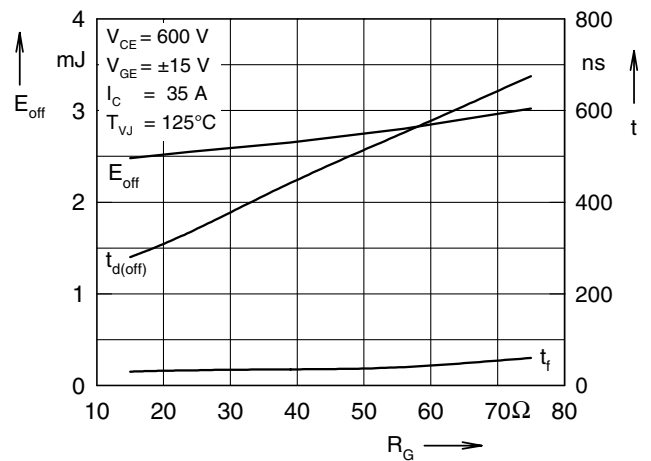


Fig.10 Typ. turn off energy and switching times versus gate resistor