

Key Features

- Trench 4 IGBTs
- Robust and soft switching freewheeling diodes in CAL technology
- Highly reliable spring contacts for electrical connections

Typical Applications

- Inverter up to 22 kVA
- Typical motor power 11 kW

Remarks

- Case temp. limited to $T_c = 125^\circ\text{C}$ max. (for baseplateless modules $T_c = T_s$)
- product rel. results valid for $T_j \leq 150$ (recomm. $T_{op} = -40\dots+150^\circ\text{C}$)

Absolute Maximum Ratings

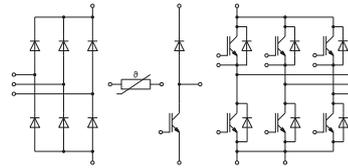


Fig. 1 Circuit configuration



Fig. 2 Module appearance

| Symbol | Conditions | | Values | Unit |
|-----------------|--|---------------------------|------------|------------------|
| Inverter - IGBT | | | | |
| V_{CES} | $T_j = 25^\circ\text{C}$ | | 1200 | V |
| I_c | $\lambda_{paste}=0.8\text{ W/(mK)}, T_j = 175^\circ\text{C}$ | $T_s = 25^\circ\text{C}$ | 48 | A |
| | | $T_s = 70^\circ\text{C}$ | 39 | A |
| I_c | $\lambda_{paste}=2.5\text{ W/(mK)}, T_j = 175^\circ\text{C}$ | $T_s = 25^\circ\text{C}$ | 53 | A |
| | | $T_s = 70^\circ\text{C}$ | 43 | A |
| I_{Cnom} | | | 35 | A |
| I_{CRM} | | | 105 | A |
| V_{GES} | | | -20...20 | V |
| t_{psc} | $V_{CC} = 800\text{ V}, V_{GE} \leq 15\text{ V}, V_{CES} \leq 1200\text{ V}$ | $T_j = 150^\circ\text{C}$ | 10 | μs |
| T_j | | | -40... 175 | $^\circ\text{C}$ |
| Chopper - IGBT | | | | |
| V_{CES} | $T_j = 25^\circ\text{C}$ | | 1200 | V |
| I_c | $\lambda_{paste}=0.8\text{ W/(mK)}, T_j = 175^\circ\text{C}$ | $T_s = 25^\circ\text{C}$ | 48 | A |
| | | $T_s = 70^\circ\text{C}$ | 39 | A |
| I_c | $\lambda_{paste}=2.5\text{ W/(mK)}, T_j = 175^\circ\text{C}$ | $T_s = 25^\circ\text{C}$ | 53 | A |
| | | $T_s = 70^\circ\text{C}$ | 43 | A |
| I_{Cnom} | | | 35 | A |
| I_{CRM} | | | 105 | A |
| V_{GES} | | | -20...20 | V |
| t_{psc} | $V_{CC} = 800\text{ V}, V_{GE} \leq 15\text{ V}, V_{CES} \leq 1200\text{ V}$ | $T_j = 150^\circ\text{C}$ | 10 | μs |
| T_j | | | -40... 175 | $^\circ\text{C}$ |

Absolute Maximum Ratings

| Symbol | Conditions | | Values | Unit |
|-----------------------------|---|-----------------------|-------------|------------------|
| Inverse - Diode | | | | |
| V_{RRM} | $T_j = 25\text{ °C}$ | | 1200 | V |
| I_F | $\lambda_{paste}=0.8\text{ W/(mK)}, T_j = 175\text{ °C}$ | $T_s = 25\text{ °C}$ | 44 | A |
| | | $T_s = 70\text{ °C}$ | 35 | A |
| I_F | $\lambda_{paste}=2.5\text{ W/(mK)}, T_j = 175\text{ °C}$ | $T_s = 25\text{ °C}$ | 49 | A |
| | | $T_s = 70\text{ °C}$ | 40 | A |
| I_{FRM} | | | 105 | A |
| I_{FSM} | $t_p = 10\text{ ms}, \sin 180^\circ, T_j = 150\text{ °C}$ | | 170 | A |
| T_j | | | -40...175 | °C |
| Freewheeling - Diode | | | | |
| V_{RRM} | $T_j = 25\text{ °C}$ | | 1200 | V |
| I_F | $\lambda_{paste}=0.8\text{ W/(mK)}, T_j = 175\text{ °C}$ | $T_s = 25\text{ °C}$ | 44 | A |
| | | $T_s = 70\text{ °C}$ | 35 | A |
| I_F | $\lambda_{paste}=2.5\text{ W/(mK)}, T_j = 175\text{ °C}$ | $T_s = 25\text{ °C}$ | 49 | A |
| | | $T_s = 70\text{ °C}$ | 40 | A |
| I_{FRM} | | | 105 | A |
| I_{FSM} | $t_p = 10\text{ ms}, \sin 180^\circ, T_j = 150\text{ °C}$ | | 170 | A |
| T_j | | | -40...175 | °C |
| Rectifier - Diode | | | | |
| V_{RRM} | $T_j = 25\text{ °C}$ | | 1600 | V |
| I_F | $\lambda_{paste}=0.8\text{ W/(mK)}, T_j = 150\text{ °C}$ | $T_s = 25\text{ °C}$ | 52 | A |
| | | $T_s = 70\text{ °C}$ | 39 | A |
| I_F | $\lambda_{paste}=2.5\text{ W/(mK)}, T_j = 150\text{ °C}$ | $T_s = 25\text{ °C}$ | 57 | A |
| | | $T_s = 70\text{ °C}$ | 43 | A |
| I_{FSM} | $t_p = 10\text{ ms}, \sin 180^\circ$ | $T_j = 25\text{ °C}$ | 370 | A |
| | | $T_j = 150\text{ °C}$ | 270 | A |
| i^2t | $t_p = 10\text{ ms}, \sin 180^\circ$ | $T_j = 25\text{ °C}$ | 685 | A ² s |
| | | $T_j = 150\text{ °C}$ | 365 | A ² s |
| T_j | | | -40 ... 150 | °C |
| Module | | | | |
| $I_{t(RMS)}$ | $T_{terminal} = 80\text{ °C}, 20\text{ A per spring}$ | | 40 | A |
| T_{stg} | module without TIM | | -40...125 | °C |
| V_{isol} | AC sinus 50 Hz, 1 min | | 2500 | V |

| Symbol | Conditions | min. | typ. | max. | Unit | |
|------------------------|---|-----------------------------------|------|------|----------|------------|
| Inverter - IGBT | | | | | | |
| $V_{CE(sat)}$ | $I_C = 35\text{ A}, V_{GE} = 15\text{ V}, \text{chiplevel}$ | $T_j = 25\text{ }^\circ\text{C}$ | | 1.85 | 2.10 | V |
| | | $T_j = 150\text{ }^\circ\text{C}$ | | 2.25 | 2.45 | V |
| V_{CEO} | chiplevel | $T_j = 25\text{ }^\circ\text{C}$ | | 0.80 | 0.90 | V |
| | | $T_j = 150\text{ }^\circ\text{C}$ | | 0.70 | 0.80 | V |
| r_{CE} | $V_{GE} = 15\text{ V}, \text{chiplevel}$ | $T_j = 25\text{ }^\circ\text{C}$ | | 30 | 34 | m Ω |
| | | $T_j = 150\text{ }^\circ\text{C}$ | | 44 | 47 | m Ω |
| $V_{GE(th)}$ | $V_{GE} = V_{CE}, I_C = 1\text{ mA}$ | 5 | 5.8 | 6.5 | V | |
| I_{CES} | $V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}, T_j = 25\text{ }^\circ\text{C}$ | | | 1 | mA | |
| C_{ies} | $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$ | $f = 1\text{ MHz}$ | | 1.95 | nF | |
| C_{oes} | | $f = 1\text{ MHz}$ | | 0.16 | nF | |
| C_{res} | | $f = 1\text{ MHz}$ | | 0.12 | nF | |
| Q_G | $V_{GE} = -8\text{ V...} + 15\text{ V}$ | | 200 | | nC | |
| R_{Gint} | $T_j = 25\text{ }^\circ\text{C}$ | | 0 | | Ω | |
| $t_{d(on)}$ | $V_{CC} = 600\text{ V}$ | $T_j = 150\text{ }^\circ\text{C}$ | | 30 | ns | |
| t_r | $I_C = 35\text{ A}$ | $T_j = 150\text{ }^\circ\text{C}$ | | 35 | ns | |
| E_{on} | | $T_j = 150\text{ }^\circ\text{C}$ | | 4.3 | mJ | |
| $t_{d(off)}$ | $R_{Gon} = 18\text{ }^\circ\Omega$ | $T_j = 150\text{ }^\circ\text{C}$ | | 300 | ns | |
| t_f | $R_{Goff} = 18\text{ }^\circ\Omega$ | $T_j = 150\text{ }^\circ\text{C}$ | | 55 | ns | |
| E_{off} | $di/dt_{on} = 830\text{ A}/\mu\text{s}$ | $T_j = 150\text{ }^\circ\text{C}$ | | 3.25 | mJ | |
| | $di/dt_{off} = 600\text{ A}/\mu\text{s}$ | | | | | |
| | $V_{GE} = +15/-15\text{ V}$ | | | | | |
| $R_{th(j-s)}$ | per IGBT, $\lambda_{paste} = 0.8\text{ W}/(\text{mK})$ | | | 1 | K/W | |
| $R_{th(j-s)}$ | per IGBT, $\lambda_{paste} = 2.5\text{ W}/(\text{mK})$ | | | 0.82 | K/W | |
| Chopper - IGBT | | | | | | |
| $V_{CE(sat)}$ | $I_C = 35\text{ A}, V_{GE} = 15\text{ V}, \text{chiplevel}$ | $T_j = 25\text{ }^\circ\text{C}$ | | 1.85 | 2.10 | V |
| | | $T_j = 150\text{ }^\circ\text{C}$ | | 2.25 | 2.45 | V |
| V_{CEO} | chiplevel | $T_j = 25\text{ }^\circ\text{C}$ | | 0.80 | 0.90 | V |
| | | $T_j = 150\text{ }^\circ\text{C}$ | | 0.70 | 0.80 | V |
| r_{CE} | $V_{GE} = 15\text{ V}, \text{chiplevel}$ | $T_j = 25\text{ }^\circ\text{C}$ | | 30 | 34 | m Ω |
| | | $T_j = 150\text{ }^\circ\text{C}$ | | 44 | 47 | m Ω |
| $V_{GE(th)}$ | $V_{GE} = V_{CE}, I_C = 1\text{ mA}$ | 5 | 5.8 | 6.5 | V | |
| I_{CES} | $V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}, T_j = 25\text{ }^\circ\text{C}$ | | | 1 | mA | |
| C_{ies} | $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$ | $f = 1\text{ MHz}$ | | 1.95 | nF | |
| C_{oes} | | $f = 1\text{ MHz}$ | | 0.16 | nF | |
| C_{res} | | $f = 1\text{ MHz}$ | | 0.12 | nF | |
| Q_G | $V_{GE} = -8\text{ V...} + 15\text{ V}$ | | 200 | | nC | |
| R_{Gint} | $T_j = 25\text{ }^\circ\text{C}$ | | 0 | | Ω | |
| $t_{d(on)}$ | $V_{CC} = 600\text{ V}$ | $T_j = 150\text{ }^\circ\text{C}$ | | 30 | ns | |
| t_r | $I_C = 35\text{ A}$ | $T_j = 150\text{ }^\circ\text{C}$ | | 35 | ns | |
| E_{on} | | $T_j = 150\text{ }^\circ\text{C}$ | | 4.3 | mJ | |
| $t_{d(off)}$ | $R_{Gon} = 18\text{ }^\circ\Omega$ | $T_j = 150\text{ }^\circ\text{C}$ | | 300 | ns | |
| t_f | $R_{Goff} = 18\text{ }^\circ\Omega$ | $T_j = 150\text{ }^\circ\text{C}$ | | 55 | ns | |
| E_{off} | $di/dt_{on} = 830\text{ A}/\mu\text{s}$ | $T_j = 150\text{ }^\circ\text{C}$ | | 3.25 | mJ | |
| | $di/dt_{off} = 600\text{ A}/\mu\text{s}$ | | | | | |
| | $V_{GE} = +15/-15\text{ V}$ | | | | | |
| $R_{th(j-s)}$ | per IGBT, $\lambda_{paste} = 0.8\text{ W}/(\text{mK})$ | | | 1 | K/W | |
| $R_{th(j-s)}$ | per IGBT, $\lambda_{paste} = 2.5\text{ W}/(\text{mK})$ | | | 0.82 | K/W | |

| Symbol | Conditions | min. | typ. | max. | Unit | |
|----------------------|--|-----------------------|------|------|------|-----|
| Inverse - Diode | | | | | | |
| $V_F = V_{EC}$ | $I_F = 35\text{ A}, V_{GE} = 0\text{ V}, \text{chiplevel}$ | $T_j = 25\text{ °C}$ | | 2.30 | 2.62 | V |
| | $I_F = 35\text{ A}, V_{GE} = 0\text{ V}, \text{chiplevel}$ | $T_j = 150\text{ °C}$ | | 2.29 | 2.62 | V |
| V_{F0} | chiplevel | $T_j = 25\text{ °C}$ | | 1.30 | 1.50 | V |
| | | $T_j = 150\text{ °C}$ | | 0.90 | 1.10 | V |
| r_F | chiplevel | $T_j = 25\text{ °C}$ | | 29 | 32 | mΩ |
| | | $T_j = 150\text{ °C}$ | | 40 | 43 | mΩ |
| I_{RRM} | $I_F = 35\text{ A}$ | $T_j = 150\text{ °C}$ | | 34 | | A |
| Q_{rr} | $di/dt_{off} = 1250\text{ A}/\mu\text{s}$ | $T_j = 150\text{ °C}$ | | 5.6 | | μC |
| E_{rr} | $V_{GE} = -15\text{ V}$ $V_{CC} = 600\text{ V}$ | $T_j = 150\text{ °C}$ | | 2.4 | | mJ |
| $R_{th(j-s)}$ | per Diode, $\lambda_{paste}=0.8\text{ W}/(\text{mK})$ | | | 1.2 | | K/W |
| $R_{th(j-s)}$ | per Diode, $\lambda_{paste}=2.5\text{ W}/(\text{mK})$ | | | 1 | | K/W |
| Freewheeling - Diode | | | | | | |
| $V_F = V_{EC}$ | $I_F = 35\text{ A}, V_{GE} = 0\text{ V}, \text{chiplevel}$ | $T_j = 25\text{ °C}$ | | 2.30 | 2.62 | V |
| | $I_F = 35\text{ A}, V_{GE} = 0\text{ V}, \text{chiplevel}$ | $T_j = 150\text{ °C}$ | | 2.29 | 2.62 | V |
| V_{F0} | chiplevel | $T_j = 25\text{ °C}$ | | 1.30 | 1.50 | V |
| | | $T_j = 150\text{ °C}$ | | 0.90 | 1.10 | V |
| r_F | chiplevel | $T_j = 25\text{ °C}$ | | 29 | 32 | mΩ |
| | | $T_j = 150\text{ °C}$ | | 40 | 43 | mΩ |
| I_{RRM} | $I_F = 35\text{ A}$ | $T_j = 150\text{ °C}$ | | 34 | | A |
| Q_{rr} | $di/dt_{off} = 1250\text{ A}/\mu\text{s}$ | $T_j = 150\text{ °C}$ | | 5.6 | | μC |
| E_{rr} | $V_{GE} = -15\text{ V}$ $V_{CC} = 600\text{ V}$ | $T_j = 150\text{ °C}$ | | 2.4 | | mJ |
| $R_{th(j-s)}$ | per Diode, $\lambda_{paste}=0.8\text{ W}/(\text{mK})$ | | | 1.2 | | K/W |
| $R_{th(j-s)}$ | per Diode, $\lambda_{paste}=2.5\text{ W}/(\text{mK})$ | | | 1 | | K/W |

| Symbol | Conditions | min. | max. | Unit | |
|--------------------|--|------------------------------------|----------------|----------|------------|
| Rectifier - Diode | | | | | |
| $V_F = V_{EC}$ | $I_F = 13 \text{ A}$, chiplevel | $T_j = 25 \text{ }^\circ\text{C}$ | 1.00 | 1.21 | V |
| | | $T_j = 125 \text{ }^\circ\text{C}$ | 0.90 | 1.10 | V |
| V_{F0} | chiplevel | $T_j = 25 \text{ }^\circ\text{C}$ | 0.88 | 0.98 | V |
| | | $T_j = 125 \text{ }^\circ\text{C}$ | 0.73 | 0.83 | V |
| r_F | chiplevel | $T_j = 25 \text{ }^\circ\text{C}$ | 9.2 | 18 | m Ω |
| | | $T_j = 125 \text{ }^\circ\text{C}$ | 13 | 21 | m Ω |
| I_R | $T_j = 145 \text{ }^\circ\text{C}$, V_{RRM} | | 1.1 | mA | |
| $R_{th(j-s)}$ | per Diode, $\lambda_{paste}=0.8 \text{ W/(mK)}$ | | 1.25 | K/W | |
| $R_{th(j-s)}$ | per Diode, $\lambda_{paste}=2.5 \text{ W/(mK)}$ | | 1.1 | K/W | |
| Module | | | | | |
| M_s | to heat sink | 2 | 2.5 | Nm | |
| w | | | 55 | g | |
| L_{CE} | | | - | nH | |
| Temperature Sensor | | | | | |
| R_{100} | $T_r=100^\circ\text{C}$ ($R_{25}=1000\Omega$) | | $1670 \pm 3\%$ | Ω | |
| $R_{(T)}$ | $R_{(T)}=1000\Omega[1+A(T-25^\circ\text{C})+B(T-25^\circ\text{C})^2]$, $A=7.635 \cdot 10^{-3} \text{ }^\circ\text{C}^{-1}$, $B=1.731 \cdot 10^{-5} \text{ }^\circ\text{C}^{-2}$ | | | | |

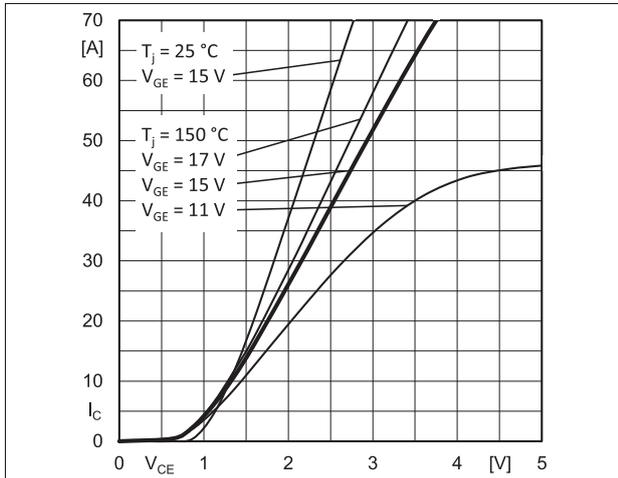


Fig. 1: Typ. output characteristic

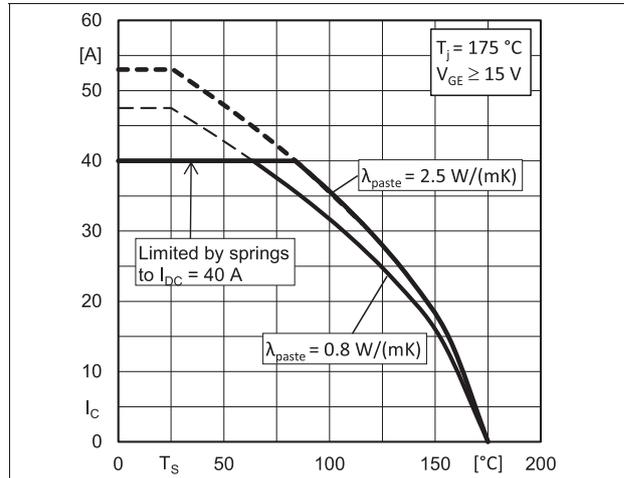


Fig. 2: Typ. rated current vs. temperature $I_c = f(T_s)$

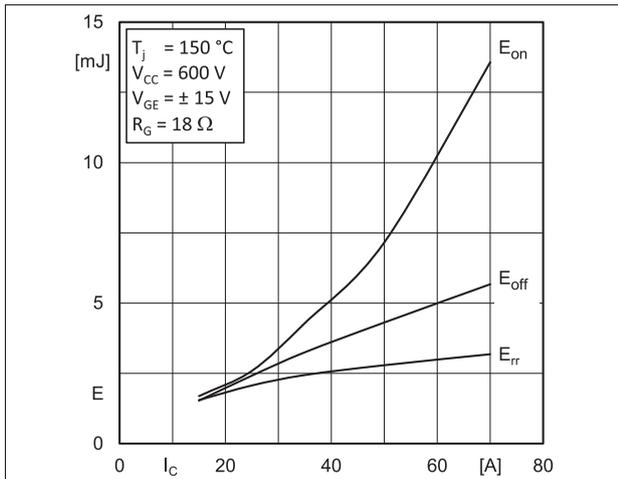


Fig. 3: Typ. turn-on /-off energy = $f(I_c)$

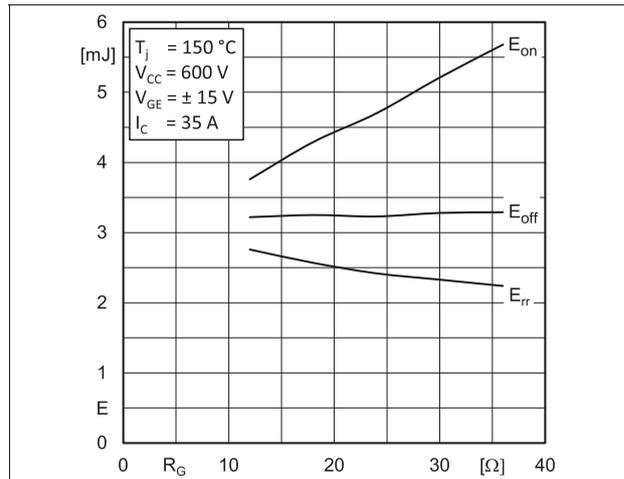


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

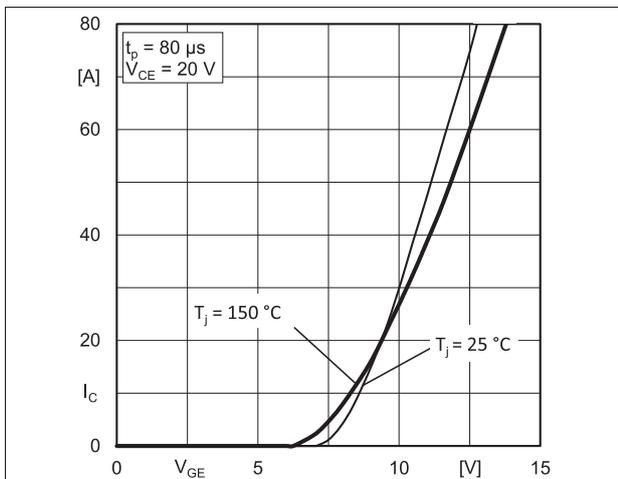


Fig. 5: Typ. transfer characteristic

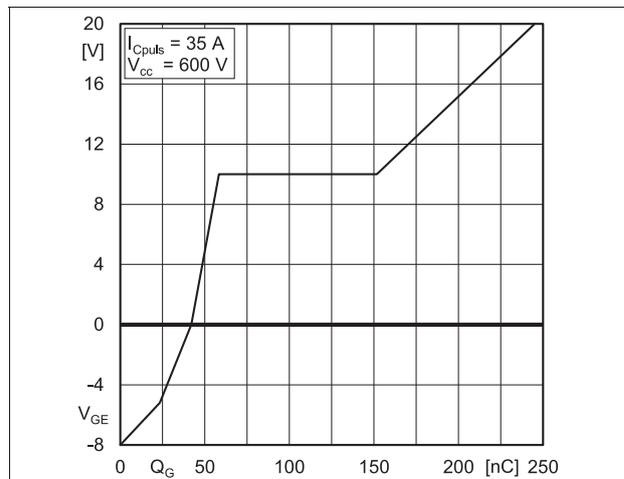
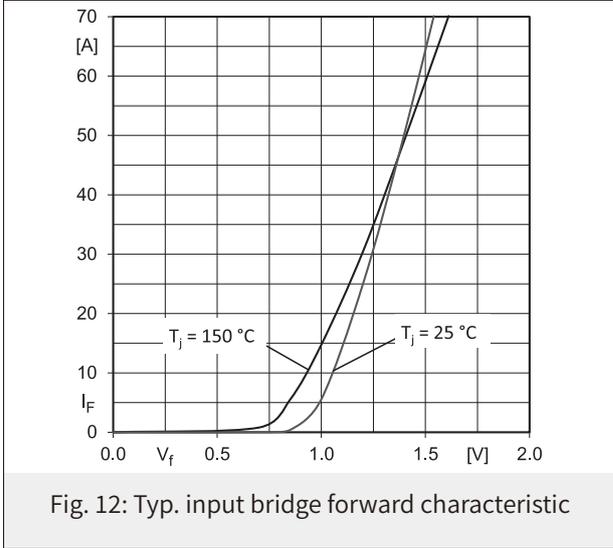
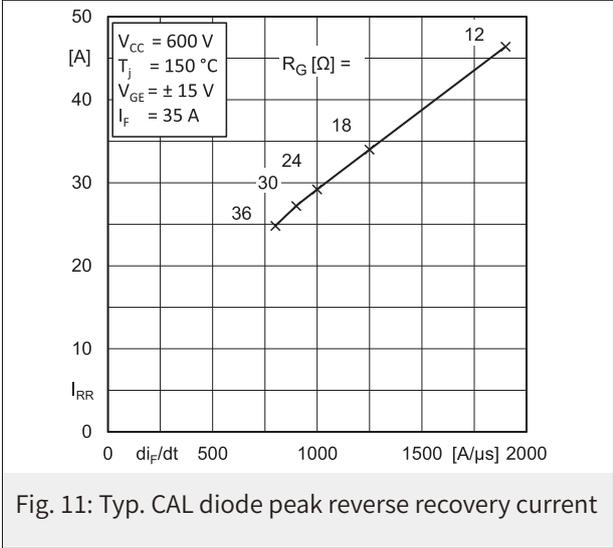
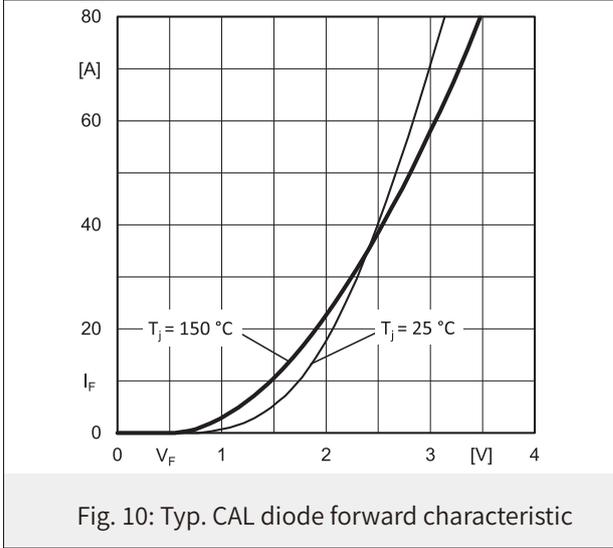
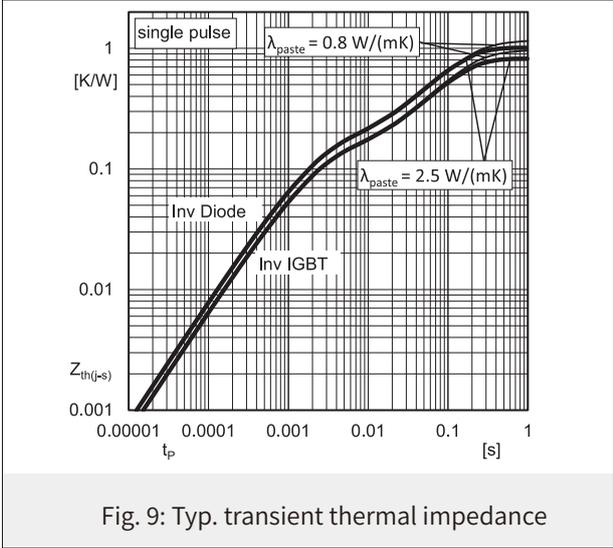
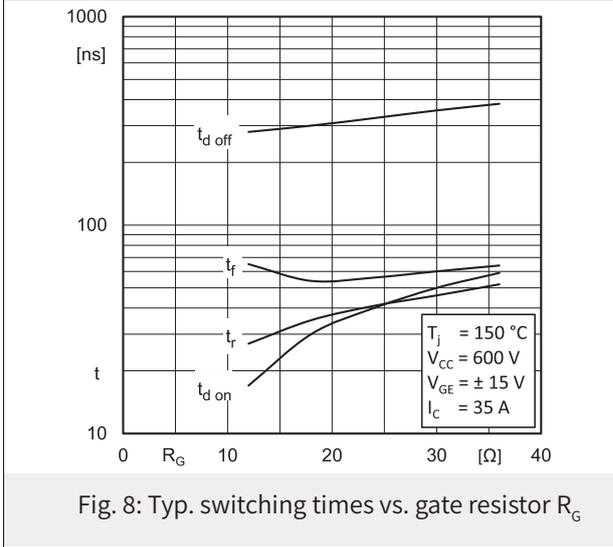
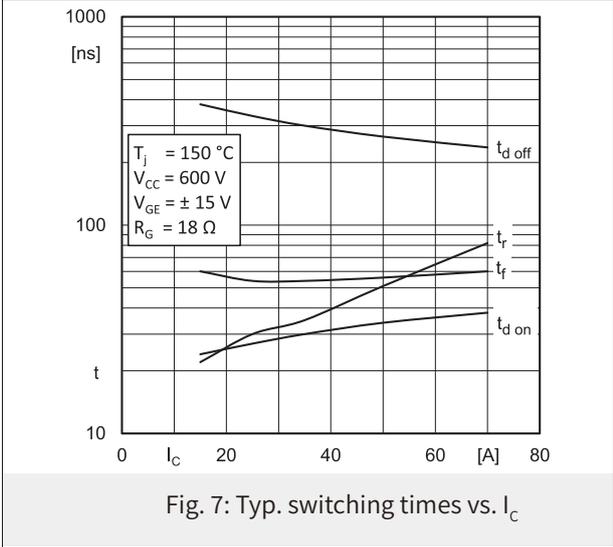


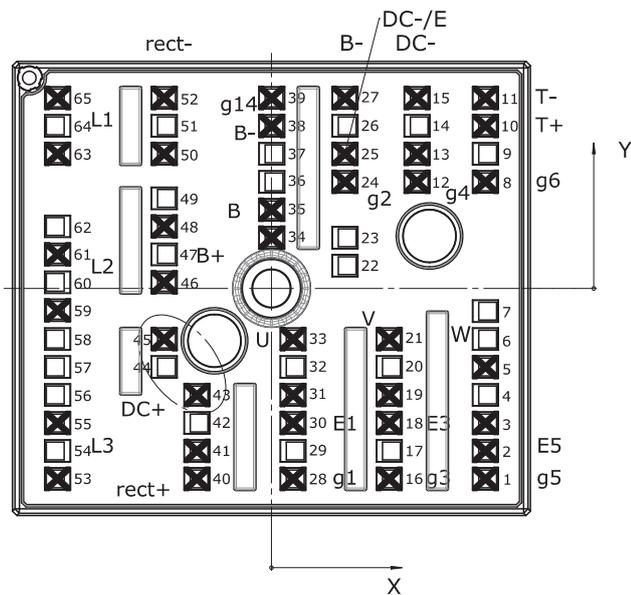
Fig. 6: Typ. gate charge characteristic



Pinout

| Pin out | | | | | | | | | | | |
|---------|-------|--------|----------|-----|--------|--------|----------|-----|--------|--------|----------|
| Pin | X | Y | Function | Pin | X | Y | Function | Pin | X | Y | Function |
| 1 | 24.38 | -21.80 | g5 | 23 | 8.38 | 5.80 | | 45 | -12.23 | -5.80 | DC+ |
| 2 | 24.38 | -18.60 | E5 | 24 | 8.38 | 12.20 | g2 | 46 | -12.23 | 0.70 | B+ |
| 3 | 24.38 | -15.40 | W | 25 | 8.38 | 15.40 | DC-/E | 47 | -12.23 | 3.90 | |
| 4 | 24.38 | -12.20 | | 26 | 8.38 | 18.60 | | 48 | -12.23 | 7.10 | B+ |
| 5 | 24.38 | -9.00 | W | 27 | 8.38 | 21.80 | B- | 49 | -12.23 | 10.30 | |
| 6 | 24.38 | -5.80 | | 28 | 2.46 | -21.80 | g1 | 50 | -12.23 | 15.40 | rect- |
| 7 | 24.38 | -2.60 | | 29 | 2.46 | -18.60 | | 51 | -12.23 | 18.60 | rect- |
| 8 | 24.38 | 12.20 | g6 | 30 | 2.46 | -15.40 | E1 | 52 | -12.23 | 21.80 | rect- |
| 9 | 24.38 | 15.40 | | 31 | 2.46 | -12.20 | U | 53 | -24.38 | -21.80 | L3 |
| 10 | 24.38 | 18.60 | T+ | 32 | 2.46 | -9.00 | | 54 | -24.38 | -18.60 | |
| 11 | 24.38 | 21.80 | T- | 33 | 2.46 | -5.80 | U | 55 | -24.38 | -15.40 | L3 |
| 12 | 16.58 | 12.20 | g4 | 34 | 0.03 | 5.80 | B | 56 | -24.38 | -12.20 | |
| 13 | 16.58 | 15.40 | DC- | 35 | 0.03 | 9.00 | B | 57 | -24.38 | -9.00 | |
| 14 | 16.58 | 18.60 | | 36 | 0.03 | 12.20 | | 58 | -24.38 | -5.80 | |
| 15 | 16.58 | 21.80 | DC- | 37 | 0.03 | 15.40 | | 59 | -24.38 | -2.50 | L2 |
| 16 | 13.42 | -21.80 | g3 | 38 | 0.03 | 18.60 | B- | 60 | -24.38 | 0.70 | |
| 17 | 13.42 | -18.60 | | 39 | 0.03 | 21.80 | g14 | 61 | -24.38 | 3.90 | L2 |
| 18 | 13.42 | -15.40 | E3 | 40 | -8.51 | -21.80 | rect+ | 62 | -24.38 | 7.10 | |
| 19 | 13.42 | -12.20 | V | 41 | -8.51 | -18.60 | rect+ | 63 | -24.38 | 15.40 | L1 |
| 20 | 13.42 | -9.00 | | 42 | -8.51 | -15.40 | | 64 | -24.38 | 18.60 | |
| 21 | 13.42 | -5.80 | V | 43 | -8.51 | -12.20 | DC+ | 65 | -24.38 | 21.80 | L1 |
| 22 | 8.38 | 2.60 | | 44 | -12.23 | -9.00 | | | | | |

all values in mm



Pinout and Dimensions

09

