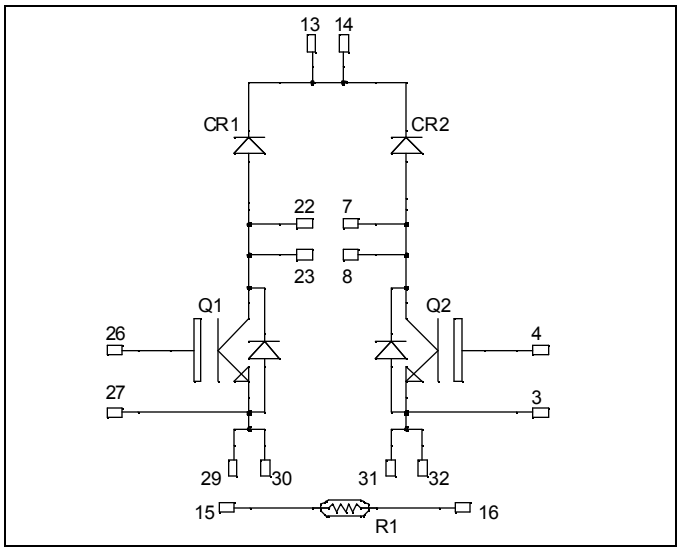
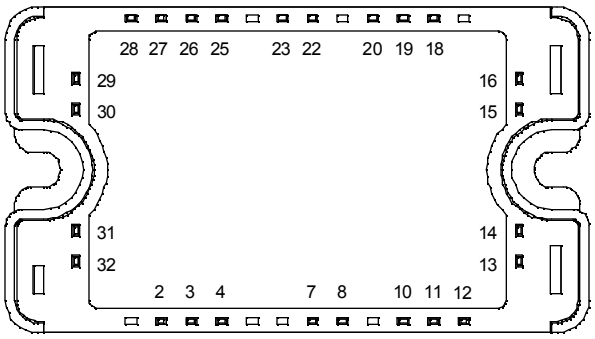
# Dual Boost chopper
# PT IGBT Power Module

$V_{CES}$ = 1200V
$I_C$ = 30A @ Tc = 80°C




All multiple inputs and outputs must be shorted together
Example: 13/14 ; 29/30 ; 22/23 …

**Application**

- AC and DC motor control
- Switched Mode Power Supplies
- Power Factor Correction

**Features**

- Power MOS 7® Punch Through (PT) IGBT
  - Low conduction loss
  - Ultra fast tail current shutoff
  - Low gate charge
  - Switching frequency capability in the 200kHz range
  - Soft recovery parallel diodes
  - Low diode VF
- Kelvin emitter for easy drive
- Very low stray inductance
  - Symmetrical design
- Internal thermistor for temperature monitoring
- High level of integration

**Benefits**

- Outstanding performance at high frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Solderable terminals both for power and signal for easy PCB mounting
- Low profile
- Each leg can be easily paralleled to achieve a single boost of twice the current capability.

## Absolute maximum ratings

| *Symbol* | *Parameter* | | *Max ratings* | *Unit* |
|---|---|---|---|---|
| $V_{CES}$ | Collector - Emitter Breakdown Voltage | | 1200 | V |
| $I_C$ | Continuous Collector Current | $T_c$ = 25°C | 45 | A |
| | | $T_c$ = 80°C | 30 | |
| $I_{CM}$ | Pulsed Collector Current | $T_c$ = 25°C | 105 | |
| $V_{GE}$ | Gate – Emitter Voltage | | ±20 | V |
| $P_D$ | Maximum Power Dissipation | $T_c$ = 25°C | 208 | W |
| RBSOA | Reverse Bias Safe Operating Area | $T_j$ = 150°C | 105A @ 960V | |

**All ratings @ $T_j$ = 25°C unless otherwise specified**

## Electrical Characteristics

| *Symbol* | *Characteristic* | *Test Conditions* | | *Min* | *Typ* | *Max* | *Unit* |
|---|---|---|---|---|---|---|---|
| $BV_{CES}$ | Collector - Emitter Breakdown Voltage | $V_{GE}$ = 0V, $I_C$ = 250µA | | 1200 | | | V |
| $I_{CES}$ | Zero Gate Voltage Collector Current | $V_{GE}$ = 0V<br>$V_{CE}$ = 1200V | $T_j$ = 25°C | | | 250 | µA |
| | | | $T_j$ = 125°C | | | 2500 | |
| $V_{CE(on)}$ | Collector Emitter on Voltage | $V_{GE}$ =15V<br>$I_C$ = 30A | $T_j$ = 25°C | | 3.3 | 3.9 | V |
| | | | $T_j$ = 125°C | | 3.0 | | |
| $V_{GE(th)}$ | Gate Threshold Voltage | $V_{GE}$ = $V_{CE}$, $I_C$ = 1 mA | | 3 | | 6 | V |
| $I_{GES}$ | Gate – Emitter Leakage Current | $V_{GE}$ = ±20V, $V_{CE}$ = 0V | | | | ±100 | nA |

## Dynamic Characteristics

| *Symbol* | *Characteristic* | *Test Conditions* | *Min* | *Typ* | *Max* | *Unit* |
|---|---|---|---|---|---|---|
| $C_{ies}$ | Input Capacitance | $V_{GE}$ = 0V<br>$V_{CE}$ = 25V<br>f = 1MHz | | 3240 | | pF |
| $C_{oes}$ | Output Capacitance | | | 248 | | |
| $C_{res}$ | Reverse Transfer Capacitance | | | 31 | | |
| $Q_g$ | Total gate Charge | $V_{GE}$ = 15V<br>$V_{Bus}$ = 600V<br>$I_C$ = 30A | | 150 | | nC |
| $Q_{ge}$ | Gate – Emitter Charge | | | 21 | | |
| $Q_{gc}$ | Gate – Collector Charge | | | 62 | | |
| $T_{d(on)}$ | Turn-on Delay Time | Inductive Switching (25°C)<br>$V_{GE}$ = 15V<br>$V_{Bus}$ = 600V<br>$I_C$ = 30A<br>$R_G$ = 5Ω | | 16 | | ns |
| $T_r$ | Rise Time | | | 20 | | |
| $T_{d(off)}$ | Turn-off Delay Time | | | 94 | | |
| $T_f$ | Fall Time | | | 40 | | |
| $E_{on1}$ | Turn-on Switching Energy | | | 750 | | µJ |
| $E_{on2}$ | Turn-on Switching Energy ❶ | | | 1305 | | |
| $E_{off}$ | Turn-off Switching Energy ❷ | | | 680 | | |
| $T_{d(on)}$ | Turn-on Delay Time | Inductive Switching (125°C)<br>$V_{GE}$ = 15V<br>$V_{Bus}$ = 600V<br>$I_C$ = 30A<br>$R_G$ = 5Ω | | 16 | | ns |
| $T_r$ | Rise Time | | | 20 | | |
| $T_{d(off)}$ | Turn-off Delay Time | | | 147 | | |
| $T_f$ | Fall Time | | | 75 | | |
| $E_{on1}$ | Turn-on Switching Energy | | | 750 | | µJ |
| $E_{on2}$ | Turn-on Switching Energy ❶ | | | 2132 | | |
| $E_{off}$ | Turn-off Switching Energy ❷ | | | 1744 | | |

❶ $E_{on2}$ includes diode reverse recovery
❷ In accordance with JEDEC standard JESD24-1

## Temperature sensor NTC

| *Symbol* | *Characteristic* | *Min* | *Typ* | *Max* | *Unit* |
|---|---|---|---|---|---|
| $R_{25}$ | Resistance @ 25°C | | 68 | | kΩ |
| $B_{25/85}$ | $T_{25}$ = 298.16 K | | 4080 | | K |

$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

T: Thermistor temperature
$R_T$: Thermistor value at T

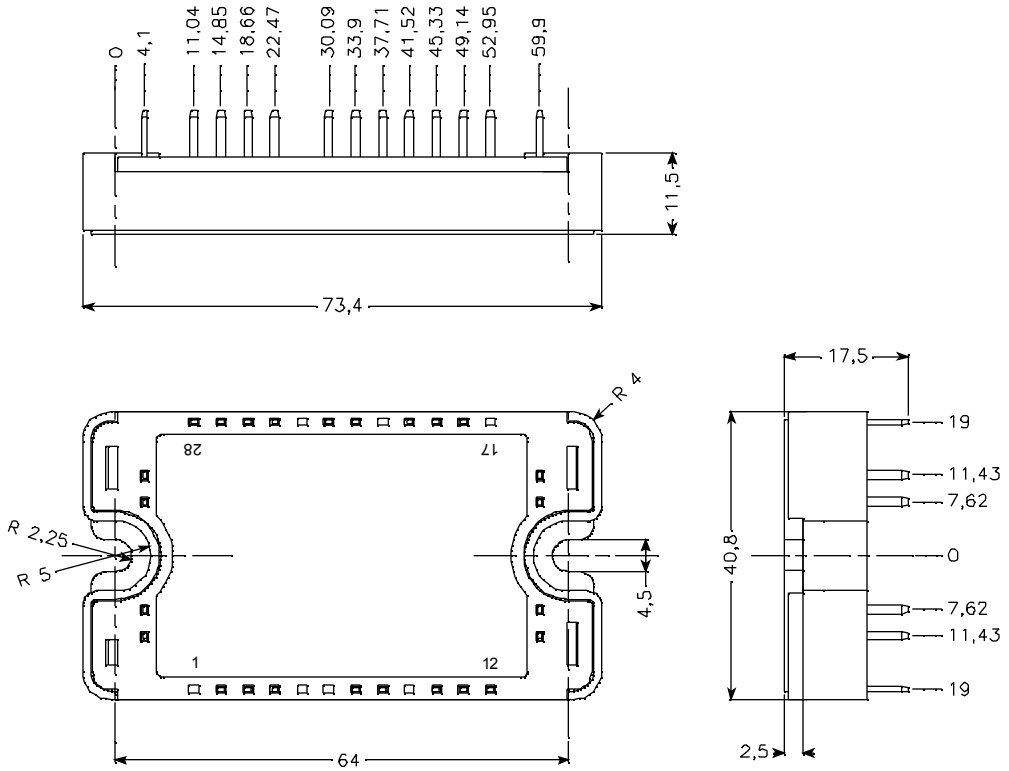
## Diode ratings and characteristics

| Symbol | Characteristic | Test Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{RRM}$ | Maximum Peak Repetitive Reverse Voltage | | | 1200 | | | V |
| $I_{RM}$ | Maximum Reverse Leakage Current | $V_R$=1200V | $T_j$ = 25°C | | | 250 | µA |
| | | | $T_j$ = 125°C | | | 500 | |
| $I_{F(AV)}$ | Maximum Average Forward Current | 50% duty cycle | Tc = 70°C | | 60 | | A |
| $V_F$ | Diode Forward Voltage | $I_F$ = 60A | | | 2 | 2.5 | V |
| | | $I_F$ = 120A | | | 2.3 | | |
| | | $I_F$ = 60A | $T_j$ = 125°C | | 1.8 | | |
| $t_{rr}$ | Reverse Recovery Time | $I_F$ = 60A<br>$V_R$ = 800V<br>di/dt =200A/µs | $T_j$ = 25°C | | 400 | | ns |
| | | | $T_j$ = 125°C | | 470 | | |
| $Q_{rr}$ | Reverse Recovery Charge | | $T_j$ = 25°C | | 1200 | | nC |
| | | | $T_j$ = 125°C | | 4000 | | |

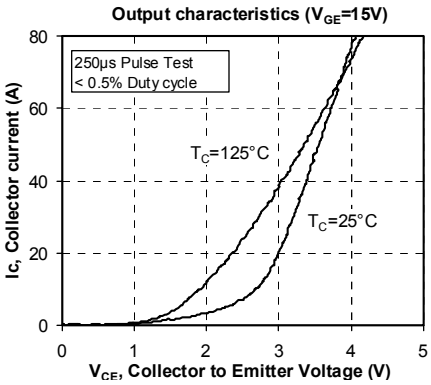
## Thermal and package characteristics

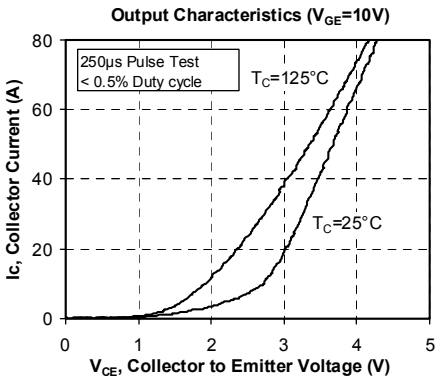
| Symbol | Characteristic | | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{thJC}$ | Junction to Case | | IGBT | | | 0.6 | °C/W |
| | | | Diode | | | 0.9 | |
| $V_{ISOL}$ | RMS Isolation Voltage, any terminal to case t =1 min, I isol<1mA, 50/60Hz | | | 2500 | | | V |
| $T_J$ | Operating junction temperature range | | | -40 | | 150 | °C |
| $T_{STG}$ | Storage Temperature Range | | | -40 | | 125 | |
| $T_C$ | Operating Case Temperature | | | -40 | | 100 | |
| Torque | Mounting torque | To heatsink | M4 | | | 4.7 | N.m |
| Wt | Package Weight | | | | | 110 | g |

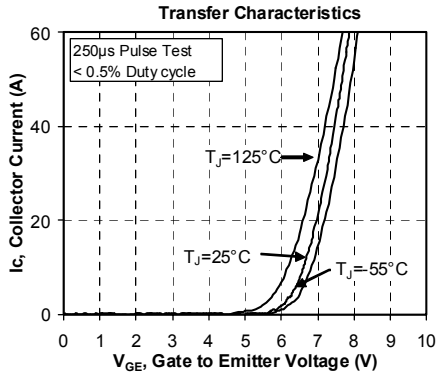
## Package outline

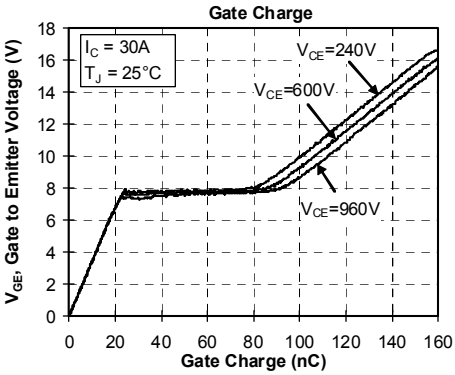


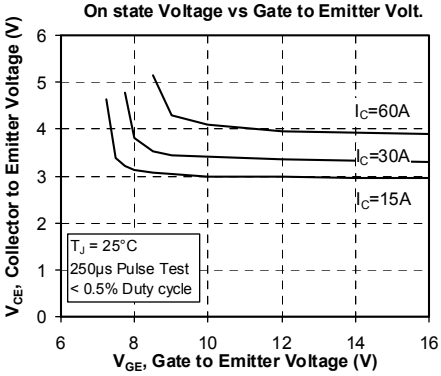
## Typical Performance Curve

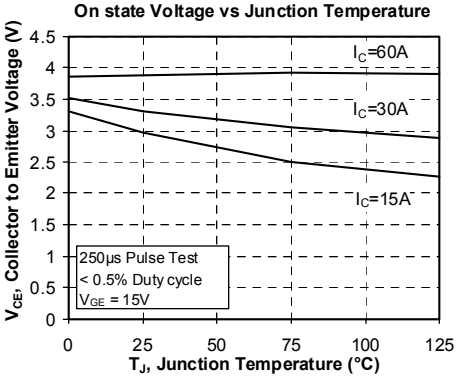


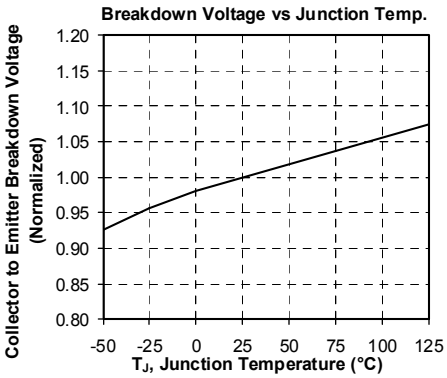



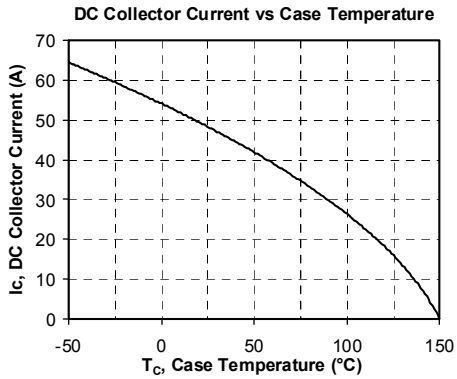



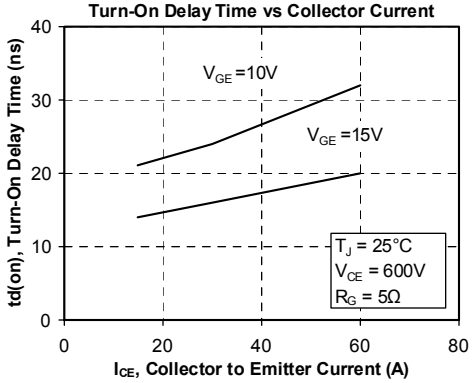



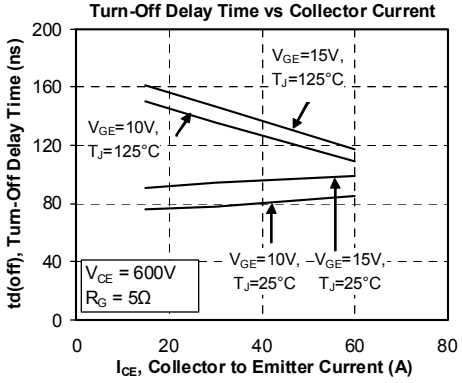



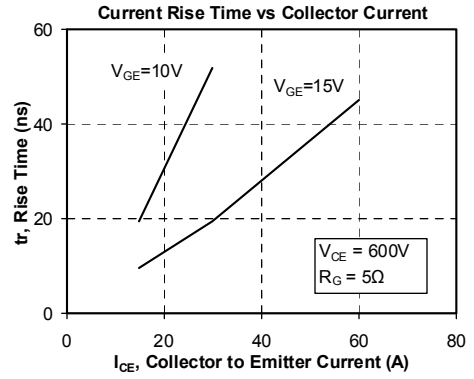
Turn-On Delay Time vs Collector Current



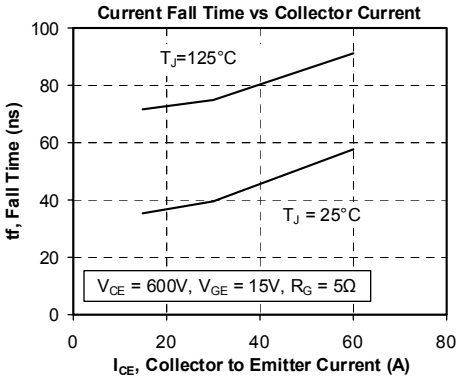

Turn-Off Delay Time vs Collector Current



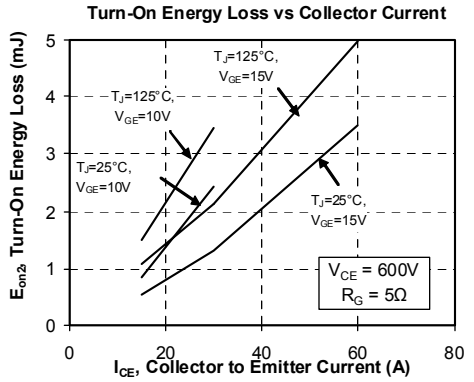

Current Rise Time vs Collector Current



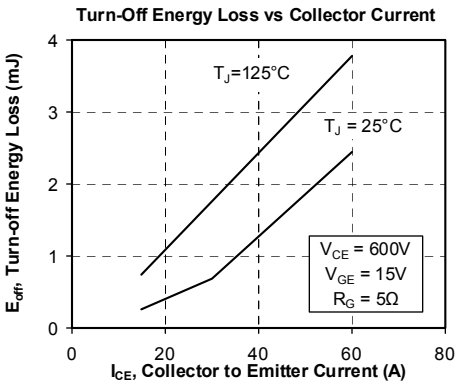

Current Fall Time vs Collector Current



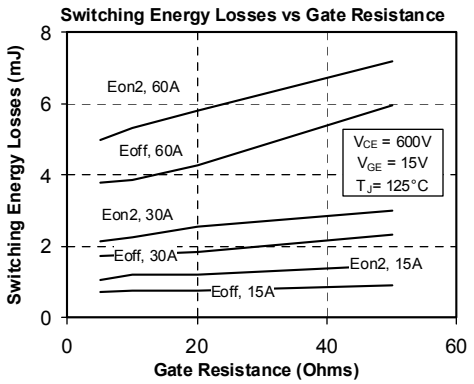

Turn-On Energy Loss vs Collector Current




Turn-Off Energy Loss vs Collector Current




Switching Energy Losses vs Gate Resistance




Switching Energy Losses vs Junction Temp.