# SKG140N120CH7DI

IGBT 1200V, 140A

## Features

- Extremely Low Switching Loss
- Very low collector-emitter saturation voltage $V_{CEsat}$
- Very soft, fast recovery antiparallel diode
- Smooth switching behavior
- Optimized for hard switching, two- and three-level topologies

## Application

- Industrial UPS
- EV-Charging
- String inverter
- Welding

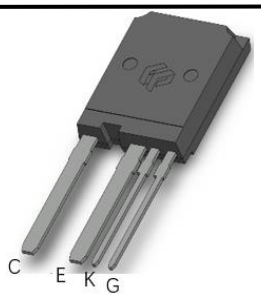
## Product Summary

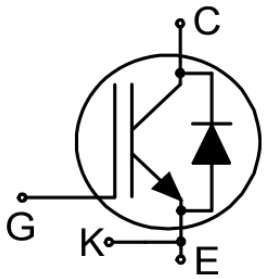
| | |
|---|---|
| $V_{CE}$ | 1200V |
| $I_C$ | 140A |
| $V_{CE(SAT)}$ | 1.7V |

***100% DVDS Tested***

***100% Double Pulse Tested***

RoHS




## Package Marking and Ordering Information

| Part # | Marking | Package | Packing | Reel Size | Tape Width | Qty |
|---|---|---|---|---|---|---|
| SKG140N120CH7DI | 140N120CH7DI | TO-247Plus-4L | Tube | N/A | N/A | 30pcs |

## Absolute Maximum Ratings

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Collector–to–Emitter Voltage | | $V_{CES}$ | 1200 | V |
| Gate–to–Emitter Voltage | | $V_{GES}$ | ±20 | V |
| Transient Gate–to–Emitter Voltage | | $V_{GES}$ | ±25 | V |
| Collector Current （limited by bondwire） | $T_C$ = 25℃ | $I_C$ | 232 | A |
| | $T_C$ = 100℃ | | 193 | |
| Pulsed Collector Current | | $I_{CM}$ | 560 | A |
| Diode Forward Current （limited by bondwire） | $T_C$ = 25℃ | $I_F$ | 170 | A |
| | $T_C$ = 91℃ | | 140 | |
| Pulsed Diode Forward Current | | $I_{FM}$ | 560 | A |
| IGBT Power Dissipation | $T_C$ = 25℃ | $P_{tot}$ | 962 | W |
| | $T_C$ = 100℃ | | 481 | |
| FRD Power Dissipation | $T_C$ = 25℃ | $P_{tot}$ | 549 | W |
| | $T_C$ = 100℃ | | 275 | |
| Operating Junction Temperature | | $T_{Vj}$ | -40~ +175 | ℃ |
| Storage Temperature | | $T_{STG}$ | -55~ +150 | ℃ |

Preliminary

## Thermal Resistance

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Thermal Resistance, Junction−Case for IGBT | $R_{thJC}$ | | 0.12 | 0.16 | ℃/W |
| Thermal Resistance, Junction−Case for Diode | | | 0.21 | 0.27 | |
| Thermal Resistance, Junction−Ambient | $R_{thJA}$ | | | 40 | |

## Electrical Characteristics ($T_J$ = 25℃ unless otherwise noted)

| Parameter | Symbol | Test Condition | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Static Characteristics** | | | | | | | |
| Collector−Emitter Breakdown Voltage | $BV_{CE}$ | $V_{GE}$=0V，$I_C$=1mA | | 1200 | | | V |
| Collector−Emitter Cut−Off Current | $I_{CES}$ | $V_{CE}$=1200V，$V_{GE}$=0V | $T_{vj}$=25℃ | | | 40 | μA |
| | | | $T_{vj}$=175℃ | | 17500 | | |
| Gate−Emitter Leakage Current | $I_{GES}$ | $V_{GE}$=20V，$V_{CE}$=0V | | | | 100 | nA |
| Gate−Emitter Threshold Voltage | $V_{GE(th)}$ | $I_C$=2.24mA，$V_{CE}$=$V_{GE}$ | | 4.7 | 5.5 | 6.2 | V |
| Collector−Emitter Saturation Voltage | $V_{CE(SAT)}$ | $I_C$=140A，$V_{GE}$=15V | $T_{vj}$=25℃ | | 1.7 | 2.15 | V |
| | | | $T_{vj}$=175℃ | | 2 | | |
| **Dynamic Characteristics** | | | | | | | |
| Input Capacitance | $C_{ies}$ | $V_{CE}$ = 25V, $V_{GE}$ = 0V, f = 100kHz | | | 18500 | | pF |
| Output Capacitance | $C_{oes}$ | | | | 317 | | |
| Reverse Transfer Capacitance | $C_{res}$ | | | | 94 | | |
| **Switching Characteristics** | | | | | | | |
| Total Gate Charge | $Q_g$ | $V_{CE}$ = 960V, $V_{GE}$ = 15V, $I_C$ = 140A | | | 1032 | | nC |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{CC}$ = 600V, $V_{GE}$ = 0/15V, $I_C$=140A, $R_{G(on)}$= 2.9Ω, $R_{G(on)}$= 2.9Ω | $T_{vj}$=25℃ | | 50 | | ns |
| | | | $T_{vj}$=175℃ | | 48 | | |
| Turn-on Rise Time | $t_r$ | | $T_{vj}$=25℃ | | 20 | | |
| | | | $T_{vj}$=175℃ | | 23 | | |
| Turn-off Delay Ttime | $t_{d(off)}$ | | $T_{vj}$=25℃ | | 407 | | |
| | | | $T_{vj}$=175℃ | | 504 | | |
| Turn-off Fall Time | $t_f$ | | $T_{vj}$=25℃ | | 37 | | |
| | | | $T_{vj}$=175℃ | | 123 | | |
| Turn−on Switching Loss | $E_{on}$ | | $T_{vj}$=25℃ | | 2.64 | | mJ |
| | | | $T_{vj}$=175℃ | | 4.42 | | |
| Turn−off Switching Loss | $E_{off}$ | | $T_{vj}$=25℃ | | 3.9 | | |
| | | | $T_{vj}$=175℃ | | 8.45 | | |
| Total Switching Loss | $E_{ts}$ | | $T_{vj}$=25℃ | | 6.54 | | |
| | | | $T_{vj}$=175℃ | | 12.9 | | |

Preliminary

## FRD Characteristic

| Parameter | Symbol | Test Condition | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| Forward Voltage | $V_F$ | $I_F$ = 140A | $T_{vj}$=25℃ | | 2.5 | 3 | V |
| | | | $T_{vj}$=175℃ | | 2.3 | | |
| Reverse Recovery Time | $t_{rr}$ | $V_R$=600V,$I_F$=140 A, $R_{G(on)}$=2.9Ω | $T_{vj}$=25℃ | | 101 | | ns |
| | | | $T_{vj}$=175℃ | | 187 | | |
| Body Diode Reverse Recovery Charge | $Q_{rr}$ | | $T_{vj}$=25℃ | | 4.14 | | μC |
| | | | $T_{vj}$=175℃ | | 13.9 | | |
| Peak Reverse Recovery Current | $I_{rrm}$ | | $T_{vj}$=25℃ | | 116 | | A |
| | | | $T_{vj}$=175℃ | | 216 | | |
| Diode peak rate of fall of reverse recovery current | $di_{rr}/dt$ | | $T_{vj}$=25℃ | | -3140 | | A/μs |
| | | | $T_{vj}$=175℃ | | -4600 | | |
| Reverse Recovery Energy | $E_{rec}$ | | $T_{vj}$=25℃ | | 1.83 | | mJ |
| | | | $T_{vj}$=175℃ | | 6.2 | | |

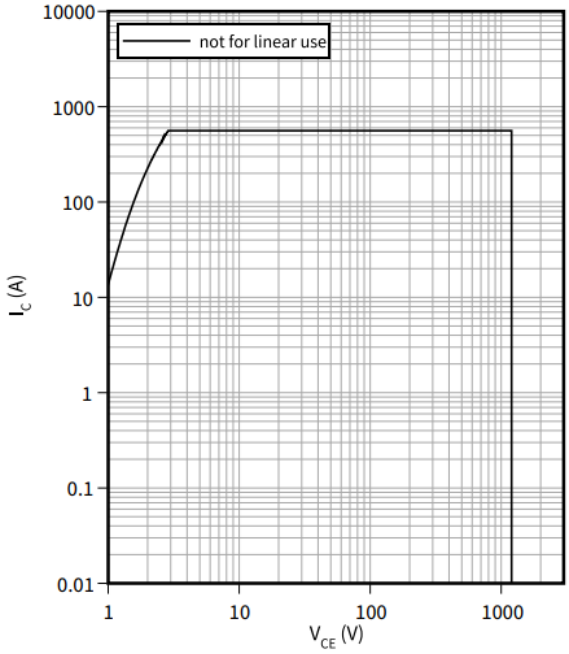
Preliminary

## Typical Performance Characteristics

### Reverse bias safe operating area

$I_C = f(V_{CE})$, $I_C = f(V_{CE})$

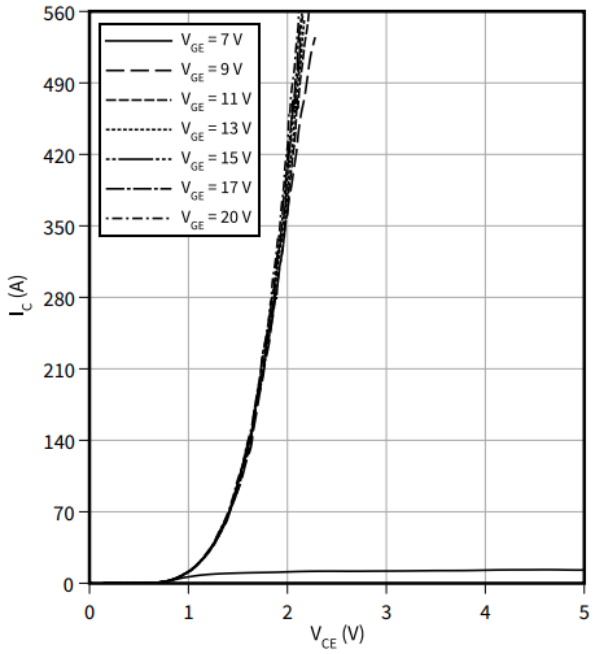
$T_{vj} \leq 175\ °C$, $V_{GE} = 0/15\ V$




### Typical output characteristic

$I_C = f(V_{CE})$

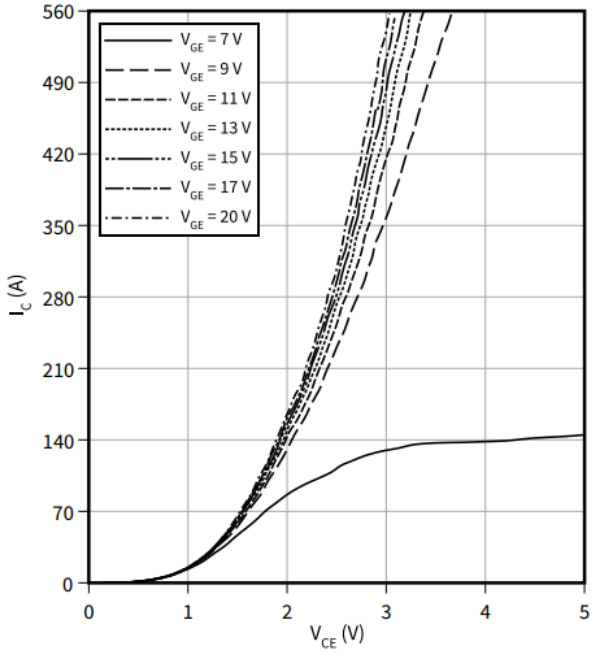
$T_{vj} = 25\ °C$




### Typical output characteristic

$I_C = f(V_{CE})$

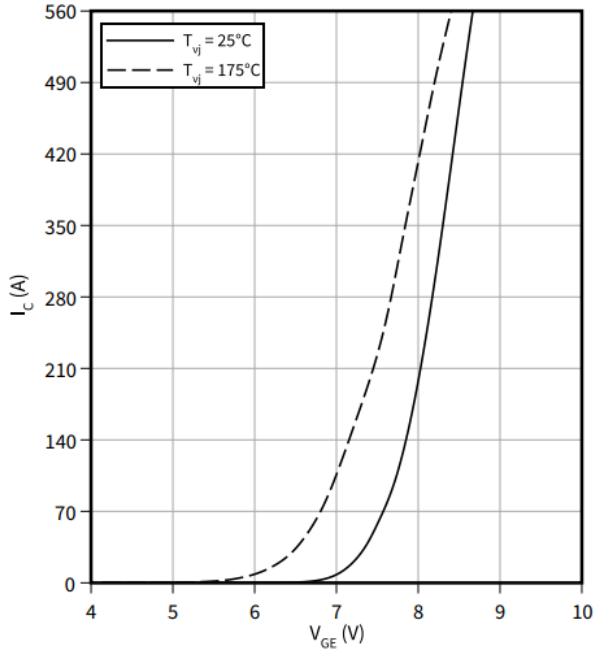
$T_{vj} = 175\ °C$




### Typical transfer characteristic

$I_C = f(V_{GE})$

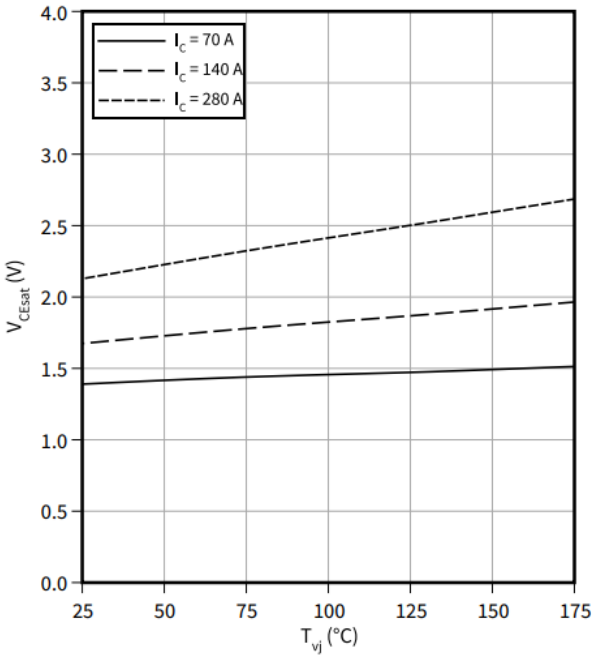
$V_{CE} = 20\ V$



**Typical collector-emitter saturation voltage as a function of junction temperature**

$V_{CEsat} = f(T_{vj})$

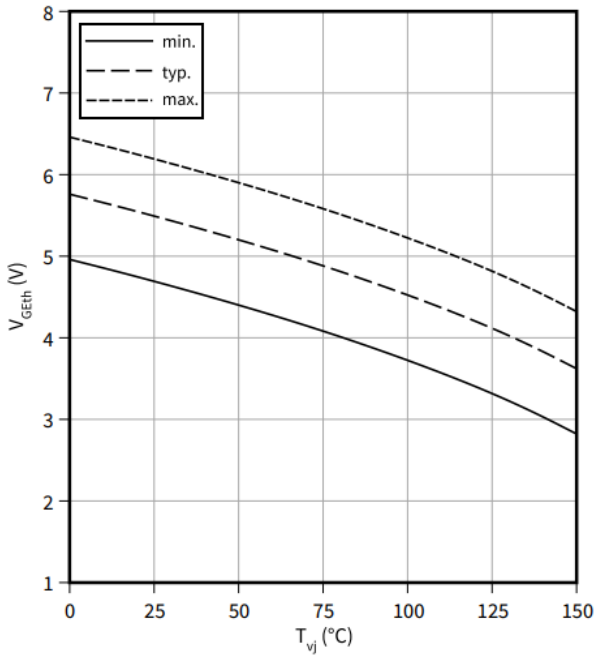
$V_{GE} = 15$ V

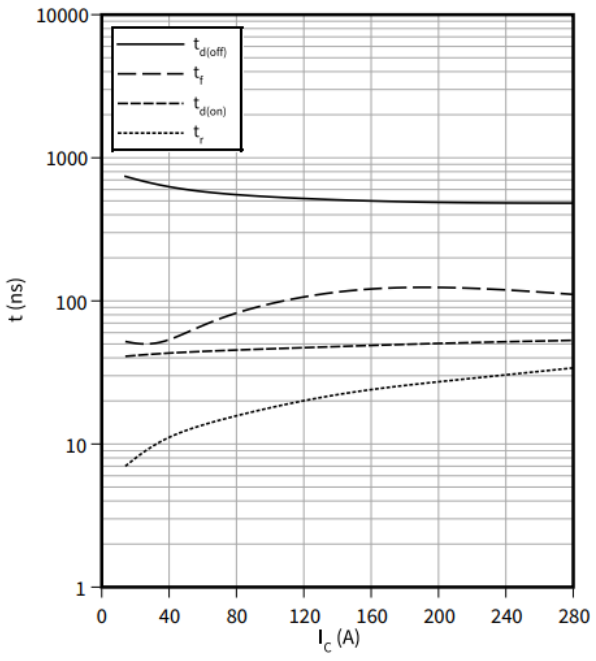


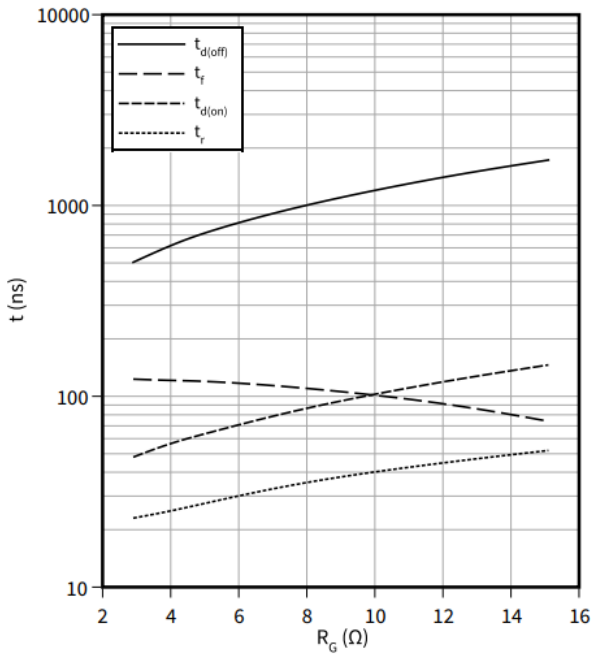

**Gate-emitter threshold voltage as a function of junction temperature**

$V_{GEth} = f(T_{vj})$

$I_C = 2.24$ mA



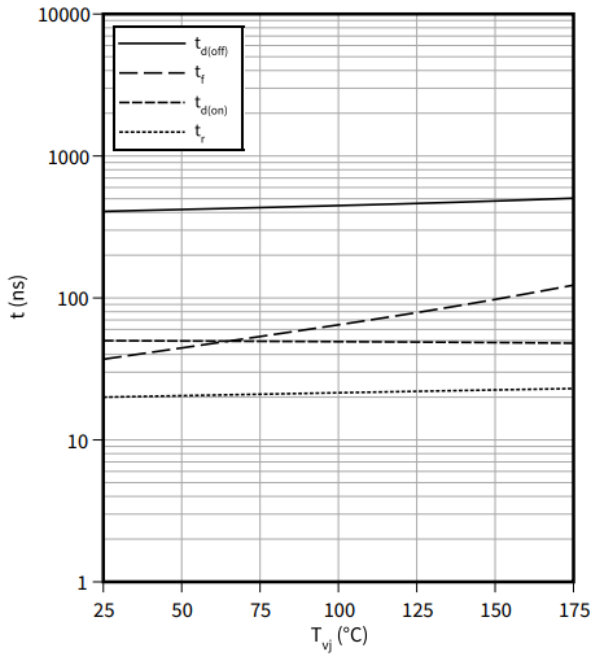



**Typical switching times as a function of junction temperature**

$t = f(T_{vj})$

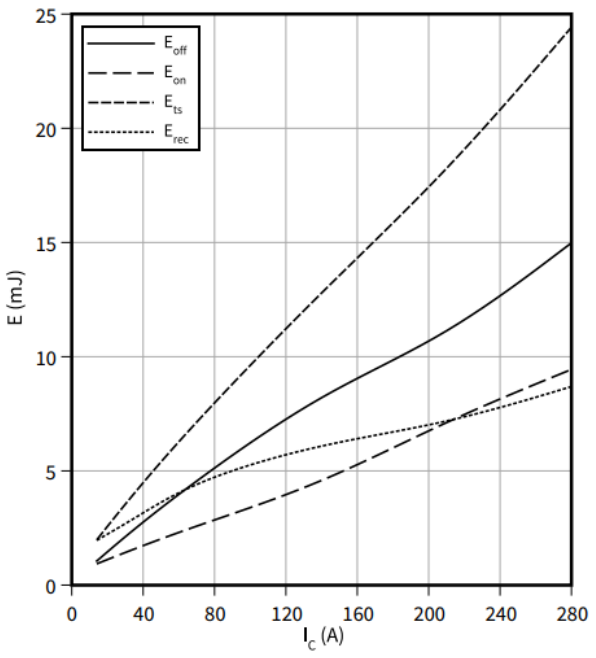
$I_C = 140\ A$, $V_{CC} = 600\ V$, $V_{GE} = 0/15\ V$, $R_G = 2.9\ \Omega$




**Typical switching energy losses as a function of collector current**

$E = f(I_C)$

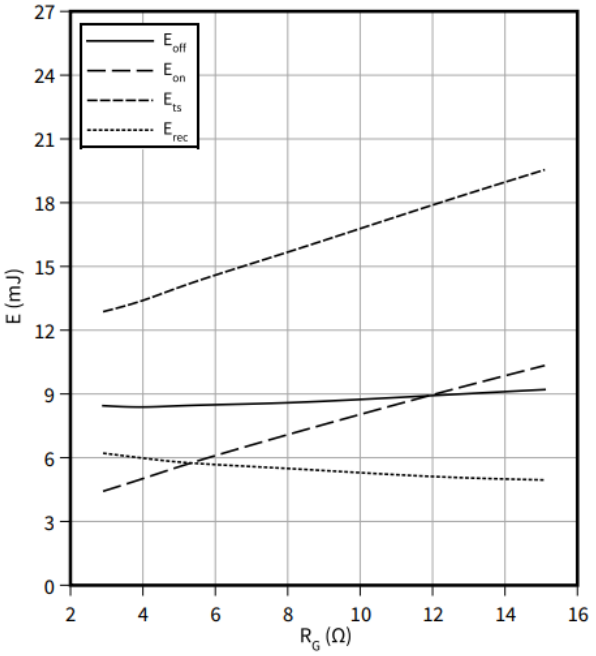
$V_{CC} = 600\ V$, $T_{vj} = 175\ °C$, $V_{GE} = 0/15\ V$, $R_G = 2.9\ \Omega$




**Typical switching energy losses as a function of gate resistor**

$E = f(R_G)$

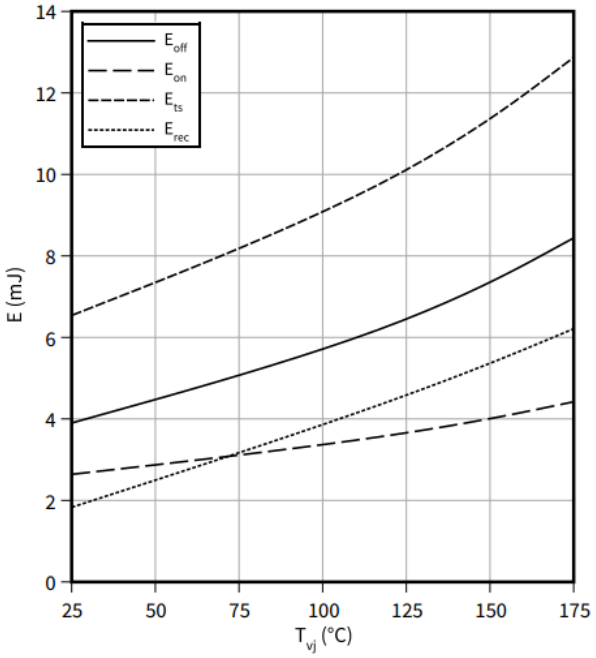
$I_C = 140\ A$, $V_{CC} = 600\ V$, $T_{vj} = 175\ °C$, $V_{GE} = 0/15\ V$




**Typical switching energy losses as a function of junction temperature**

$E = f(T_{vj})$

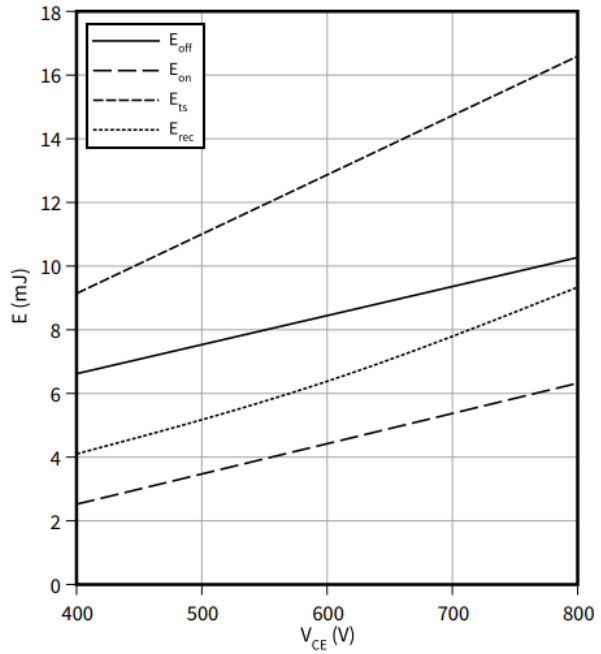
$I_C = 140\ A$, $V_{CC} = 600\ V$, $V_{GE} = 0/15\ V$, $R_G = 2.9\ \Omega$



**Typical switching energy losses as a function of collector emitter voltage**

$E = f(V_{CE})$

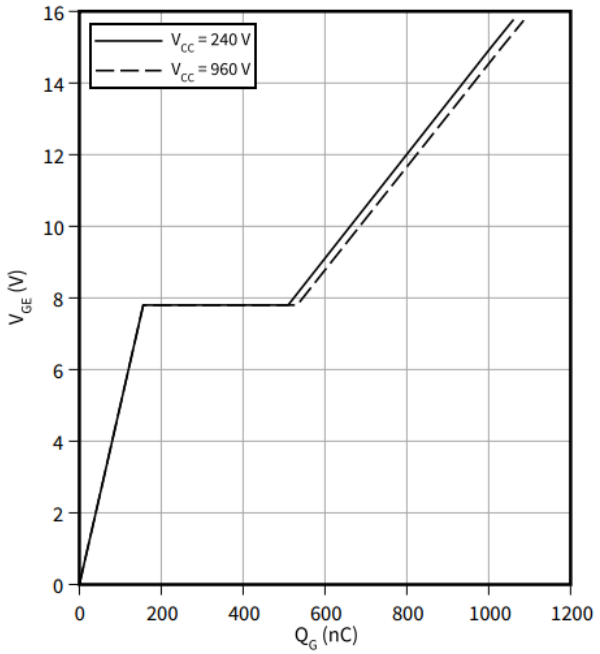
$I_C = 140\ A$, $V_{GE} = 0/15\ V$, $T_{vj} = 175\ °C$, $R_G = 2.9\ \Omega$




**Typical gate charge**

$V_{GE} = f(Q_G)$

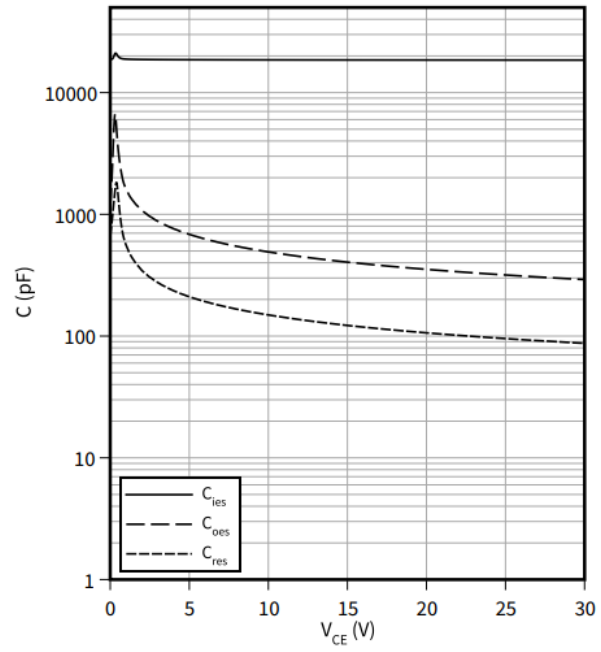
$I_C = 140\ A$




**Typical capacitance as a function of collector-emitter voltage**

$C = f(V_{CE})$

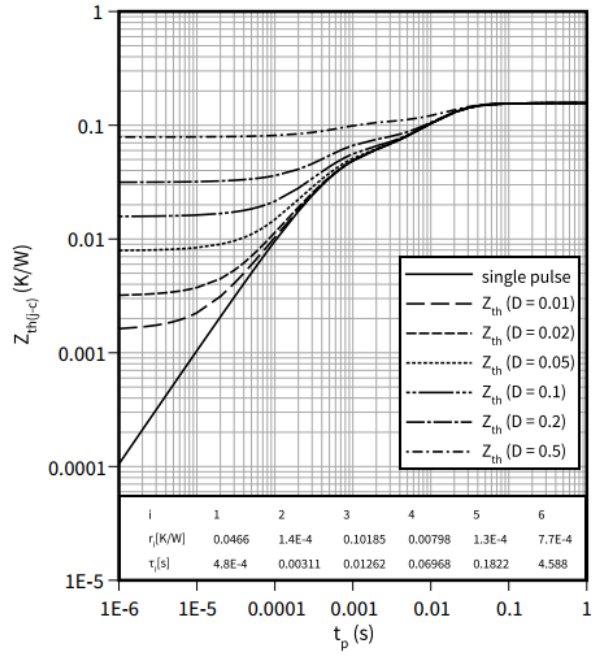
$f = 100\ kHz$, $V_{GE} = 0\ V$




**IGBT transient thermal impedance as a function of pulse width**

$Z_{th(j-c)} = f(t_p)$

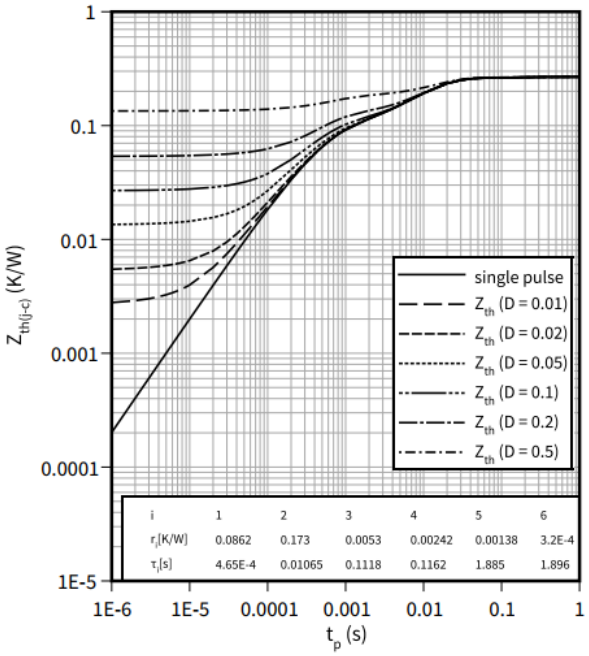
$D = t_p/T$



**Diode transient thermal impedance as a function of pulse width**

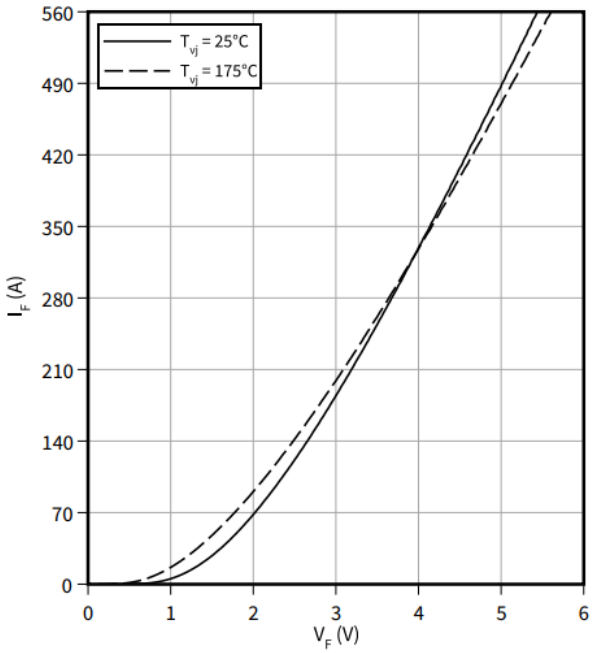
$Z_{th(j-c)} = f(t_p)$

$D = t_p/T$



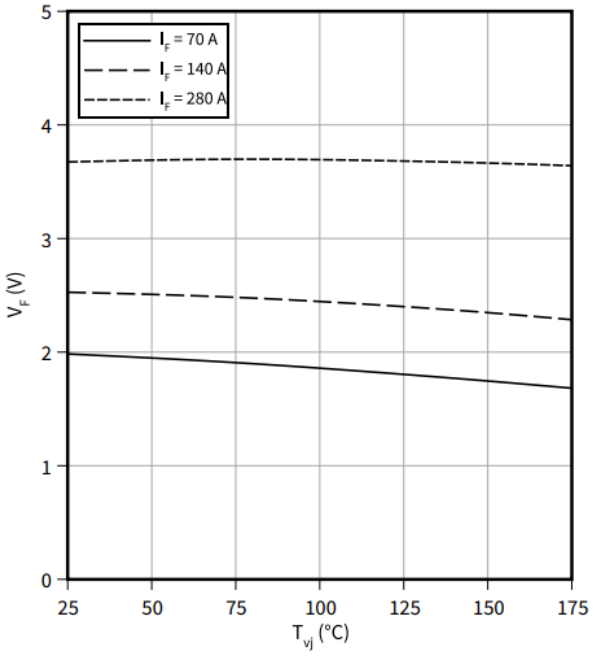

**Typical diode forward current as a function of forward voltage**

$I_F = f(V_F)$




**Typical diode forward voltage as a function of junction temperature**

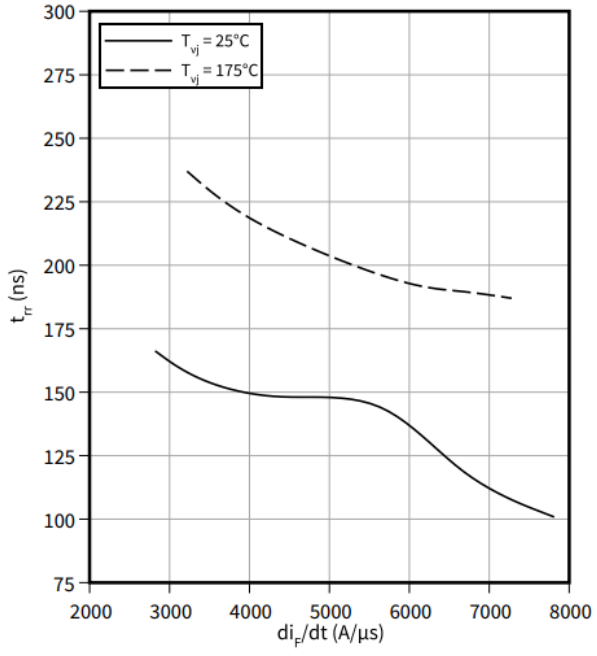
$V_F = f(T_{vj})$




**Typical reverse recovery time as a function of diode current slope**

$t_{rr} = f(di_F/dt)$

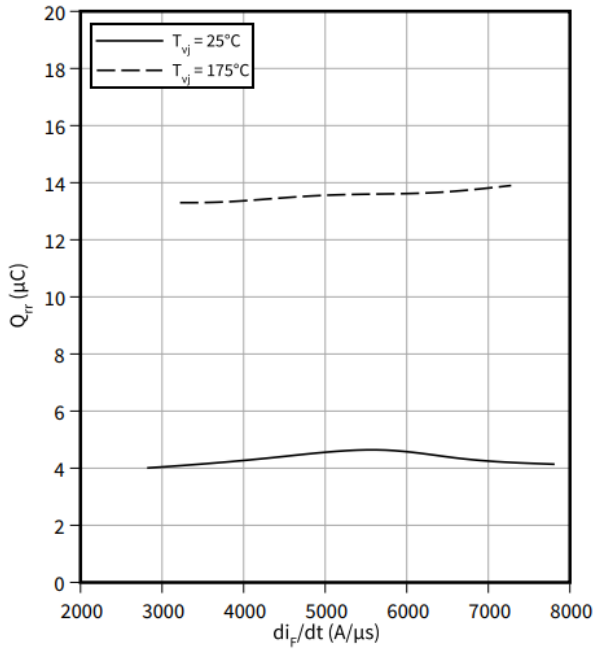
$V_R$ = 600 V, $I_F$ = 140 A



**Typical reverse recovery charge as a function of diode current slope**

$Q_{rr} = f(di_F/dt)$

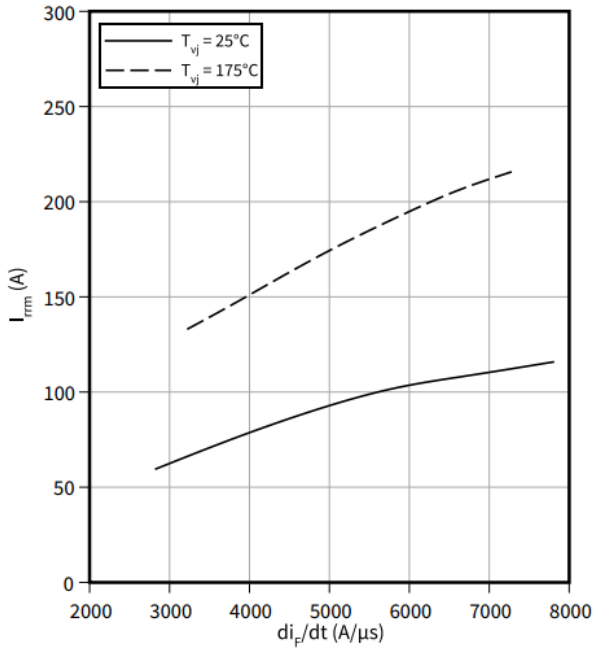
$V_R = 600\ V$, $I_F = 140\ A$




**Typical reverse recovery current as a function of diode current slope**

$I_{rrm} = f(di_F/dt)$

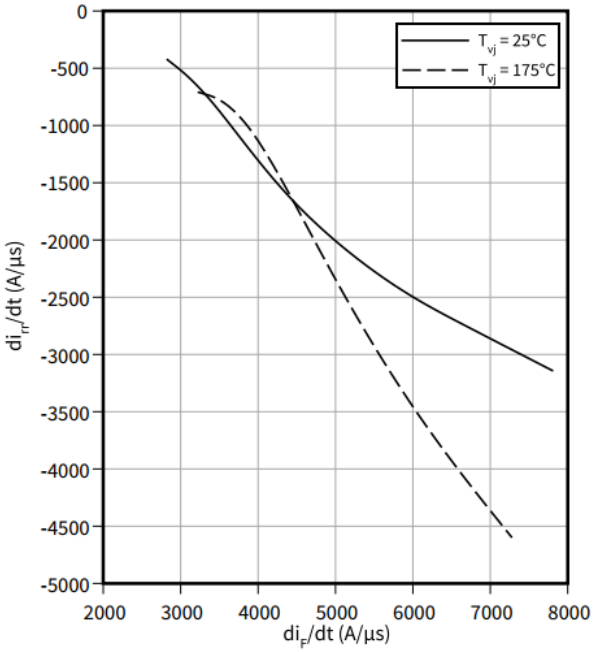
$V_R = 600\ V$, $I_F = 140\ A$




**Typical diode peak rate of fall of reverse recovery current as a function of diode current slope**

$di_{rr}/dt = f(di_F/dt)$

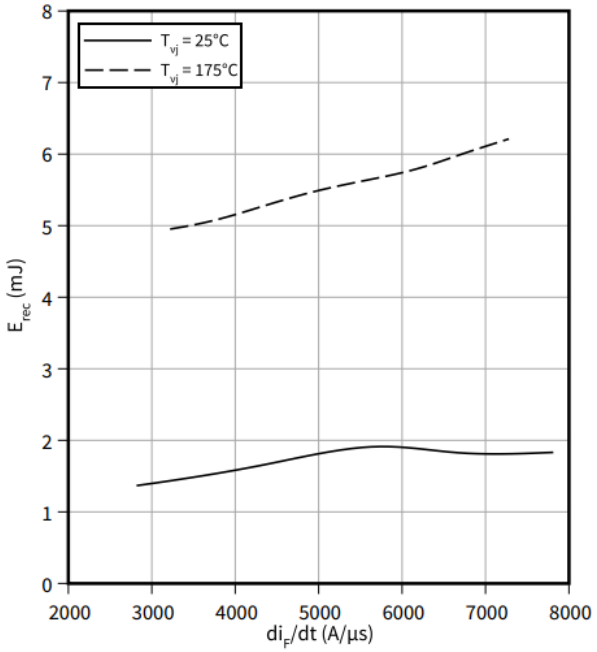
$V_R = 600\ V$, $I_F = 140\ A$




**Typical reverse energy losses as a function of diode current slope**

$E_{rec} = f(di_F/dt)$

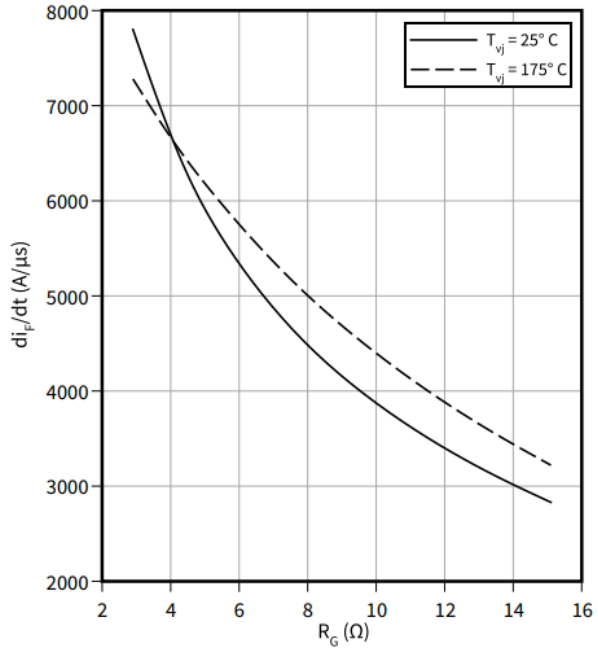
$V_R = 600\ V$, $I_F = 140\ A$



**Typical diode current slope as a function of gate resistor**

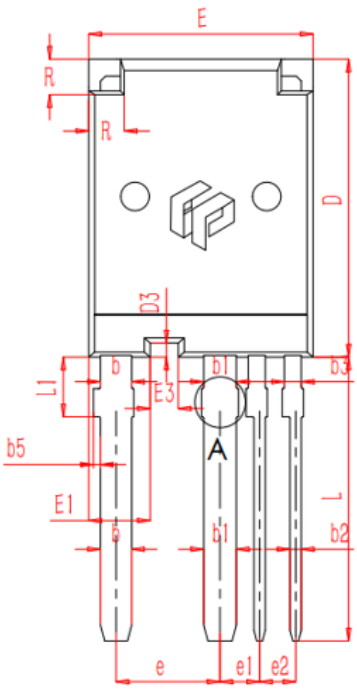
$di_F/dt = f(R_G)$

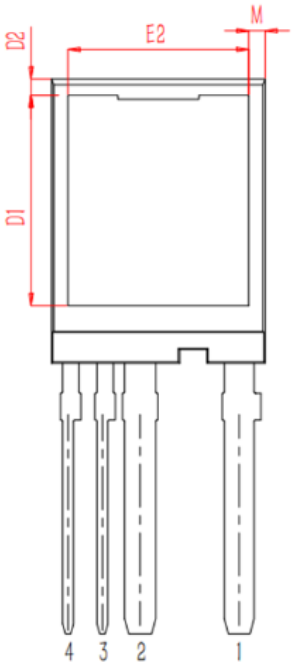
$V_R = 600\ V$, $I_F = 140\ A$

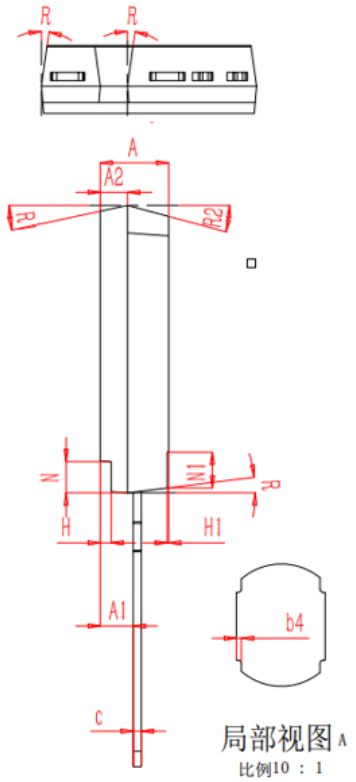



Preliminary

## Package Outline TO247PLUS-4L




| DIMENSION | MILLIMETERS | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 4.95 | 5 | 5.05 |
| A1 | 2.36 | 2.41 | 2.46 |
| A2 | 1.95 | 2 | 2.05 |
| b | 2.15 | 2.2 | 2.25 |
| b1 | 2.25 | 2.3 | 2.35 |
| b2 | 0.75 | 0.8 | 0.85 |
| b3 | 1.15 | 1.2 | 1.25 |
| b4 | | MAX0.075 | |
| b5 | 0.45 | 0.5 | 0.55 |
| c | 0.595 | 0.6 | 0.635 |
| D | 20.9 | 21 | 21.1 |
| D1 | 15.05 | 15.55 | 16.05 |
| D2 | 1.15 | 1.2 | 1.25 |
| D3 | 0.95 | 1 | 1.05 |
| E | 15.75 | 15.8 | 16.85 |
| E1 | 4.2 | 4.33 | 4.4 |
| E2 | 13.3 | 13.37 | 13.5 |
| E3 | 1.95 | 2 | 2.05 |
| e | | 7.32 | |
| e1 | | 2.79 | |
| e2 | | 2.54 | |
| H | 0.75 | 0.8 | 0.85 |
| H1 | 0.05 | 0.1 | 0.15 |
| L | 19.9 | 20 | 20.1 |
| L1 | 4.1 | 4.2 | 4.3 |
| M | 1.17 | 1.22 | 1.27 |
| N | 2.2 | 2.3 | 2.4 |
| N1 | 2.5 | 2.6 | 2.7 |
| R | 2.2 | 2.5 | 2.8 |
| S | | 8° | |
| S1 | | 12° | |
| S2 | | 15° | |

Preliminary

## Revision History

| Revision | Date | Major Changes |
|---|---|---|
| Preliminary | 2024-8-23 | Release of provisional version |

## Disclaimer

Unless otherwise specified in the datasheet, the product is designed and qulified as astandard commercial product and is not intended for use in applications that require extraordinary levels of quality and reliability, such as automotive, aviation/aerospace and life-support devices or systems.

Any and all semiconductor products have certain probability to fail or malfunction, which may result in personal injury, death or property damage. Customer are solely responsible for providing adequate safe measures when design their systems.

Scilicon Electric reserves the right to improve product design,function and reliability without notice.

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