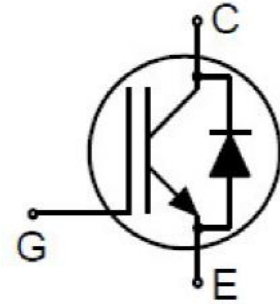


### Features

- High breakdown voltage to 650V for improved reliability
- Trench-stop technology offering:
  - High speed switching
  - High ruggedness, temperature stable behavior
  - Short circuit withstand time: 10 $\mu$ s
  - Low  $V_{CE(SAT)}$
  - Easy parallel switching capability due to positive temperature coefficient in  $V_{CE(SAT)}$
- Enhanced avalanche capability

HF

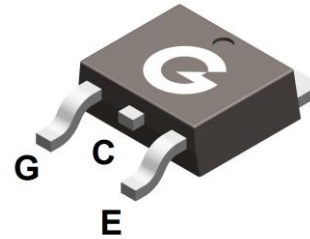


### Applications

- Uninterruptible power supplies
- Solar inverter

### Mechanical Data

- Case: TO-252
- Molding Compound: UL Flammability Classification Rating 94V-0
- Terminals: Matte tin-plated leads; solderability-per MIL-STD-202, Method 208



TO-252

### Ordering Information

Part Number	Package	Shipping Quantity	Marking Code
GKD05N65	TO-252	80 pcs / Tube & 2500 pcs / Tape & Reel	KD05N65

### Maximum Ratings (@ $T_C = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Value	Unit
Collector-to-Emitter Voltage	$V_{CES}$	650	V
Gate-Emitter Voltage	$V_{GES}$	$\pm 20$	V
DC Collector Current ( $T_C = 25^\circ\text{C}$ , limited by maximum $T_J$ )	$I_C$	10	A
DC Collector Current ( $T_C = 100^\circ\text{C}$ , limited by maximum $T_J$ )		5	A
Diode Continuous Forward Current ( $T_C = 25^\circ\text{C}$ , limited by maximum $T_J$ )	$I_F$	10	A
Diode Continuous Forward Current ( $T_C = 100^\circ\text{C}$ , limited by maximum $T_J$ )		5	A
Pulsed Collector Current (Pulse width limited by maximum $T_J$ , $V_{GE} = 15\text{V}$ )	$I_{CM}$	15	A
Short Circuit Withstand Time ( $V_{GE} = 15\text{V}$ , $V_{CE} \leq 400\text{V}$ )	$T_{SC}$	10	$\mu\text{s}$
Soldering Temperature, Wave Soldering 1.6mm (0.063in.) from Case for 10s	$T_{sold}$	260	$^\circ\text{C}$
Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_D$	55	W
Operating Junction Temperature Range	$T_J$	-55 ~ +150	$^\circ\text{C}$
Storage Temperature Range	$T_{STG}$	-55 ~ +150	$^\circ\text{C}$

### Thermal Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal Resistance Junction-to-Case, IGBT	R <sub>θJC</sub>	-	1.8	2.3	°C/W
Thermal Resistance Junction-to-Case, Diode		-	2.45	3	°C/W
Thermal Resistance Junction-to-Air	R <sub>θJA</sub>	-	-	62.5	°C/W

### Electrical Characteristics of the IGBT (@ T<sub>J</sub> = 25°C unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
<b>Static Characteristics</b>						
V <sub>(BR)CES</sub>	Collector-Emitter Breakdown Voltage	V <sub>GE</sub> = 0V, I <sub>C</sub> = 250μA	650	-	-	V
		V <sub>GE</sub> = 0V, I <sub>C</sub> = 1mA	650	-	-	V
I <sub>CES</sub>	Collector-Emitter Leakage Current	V <sub>CE</sub> = 650V, V <sub>GE</sub> = 0V	-	-	10	μA
I <sub>GES</sub>	Gate to Emitter Leakage Current	V <sub>GE</sub> = ±20V, V <sub>CE</sub> = 0V	-	-	±200	nA
V <sub>CE(sat)</sub>	Collector-Emitter Saturation Voltage	V <sub>GE</sub> = 15V, I <sub>C</sub> = 5A	-	1.5	2.05	V
V <sub>GE(th)</sub>	Gate Threshold Voltage	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250μA	4	5.5	6.5	V
R <sub>G</sub>	Gate Resistance	V <sub>GE</sub> = 0V, f = 1MHz	-	4.6	-	Ω
<b>Dynamic Characteristics</b>						
Q <sub>G</sub>	Total Gate-Charge	V <sub>CC</sub> = 400V, V <sub>GE</sub> = 15V, I <sub>C</sub> = 5A	-	17	-	nC
C <sub>ies</sub>	Input Capacitance	V <sub>CE</sub> = 25V V <sub>GE</sub> = 0V f = 1MHz	-	342	-	pF
C <sub>oes</sub>	Output Capacitance					
C <sub>res</sub>	Reverse Transfer Capacitance					
I <sub>C(SC)</sub>	Short Circuit Collector Current	V <sub>GE</sub> = 15V, t <sub>SC</sub> ≤ 10μs V <sub>CC</sub> = 400V, T <sub>J</sub> = 25°C	-	30	-	A
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>CE</sub> = 400V V <sub>GE</sub> = 15V I <sub>C</sub> = 5A R <sub>G</sub> = 60Ω T <sub>J</sub> = 25°C	-	44	-	ns
t <sub>r</sub>	Turn-on Rise Time					
t <sub>d(off)</sub>	Turn-Off Delay Time					
t <sub>f</sub>	Turn-Off Fall Time					
E <sub>on</sub>	Turn-On Switching Loss	T <sub>J</sub> = 25°C	-	0.348	-	mJ
E <sub>off</sub>	Turn-Off Switching Loss		-	0.062	-	

### Electrical Characteristics of the Diode (@ T<sub>J</sub> = 25°C unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
<b>Dynamic Characteristics</b>						
V <sub>FM</sub>	Diode Forward Voltage	I <sub>F</sub> = 5A, V <sub>GE</sub> = 0V	-	1.7	2.2	V
t <sub>rr</sub>	Reverse recovery time	V <sub>GE</sub> = 0V, I <sub>F</sub> = 5A di/dt = 200A/μs	-	83	-	ns
Q <sub>rr</sub>	Reverse recovery charge		-	194	-	nC
I <sub>rrm</sub>	Peak Reverse Recovery Current		-	4.4	-	A

Ratings and Characteristics Curves (@  $T_A = 25^\circ\text{C}$  unless otherwise specified)

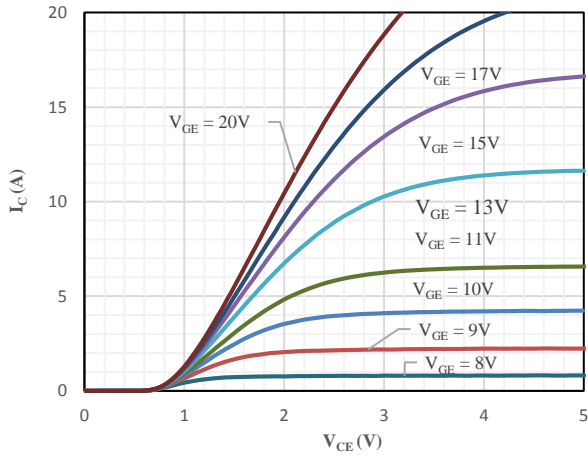


Fig 1 Typical Output Characteristics

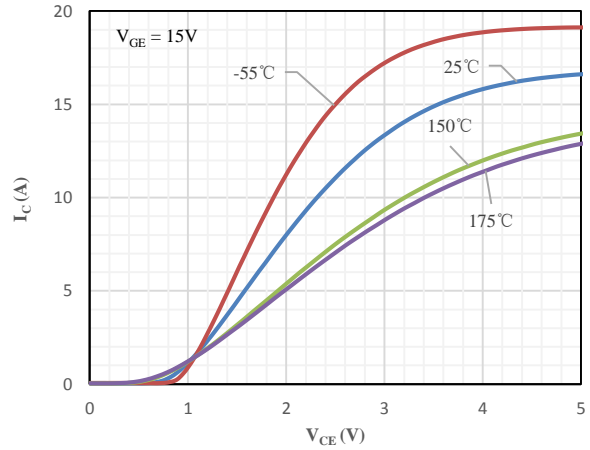


Fig 2 Saturation Voltage Characteristics

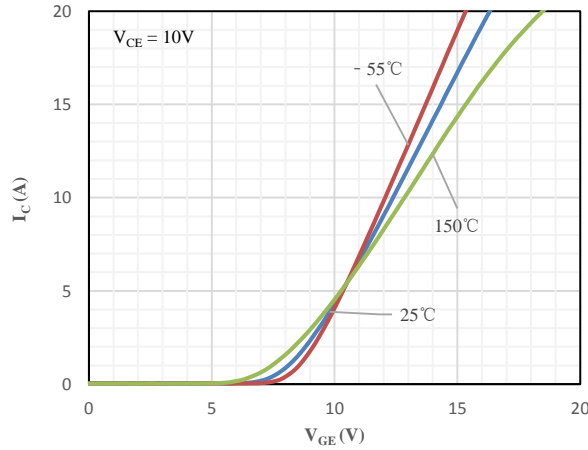


Fig 3 Transfer Characteristics

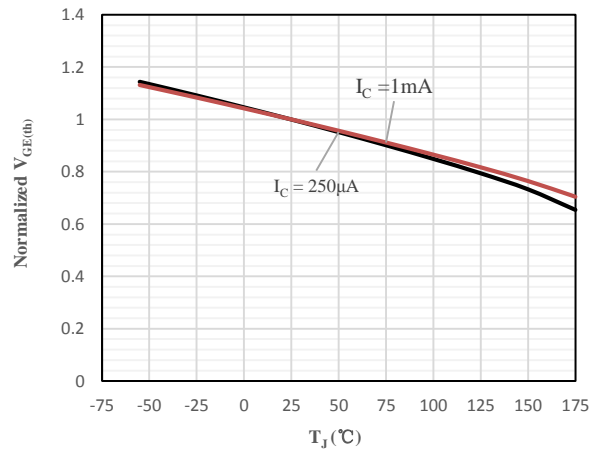


Fig 4 Normalized  $V_{GE(th)}$  vs. Junction Temperature

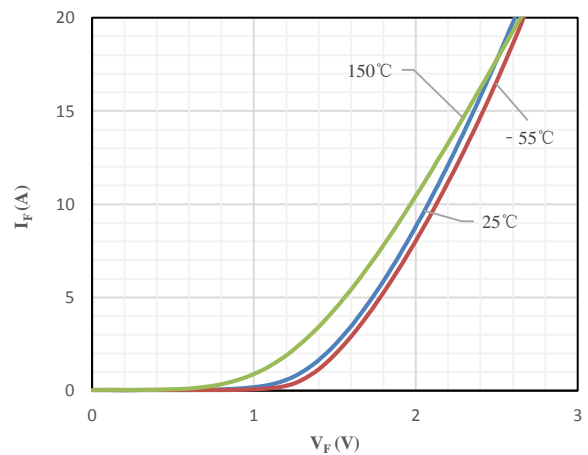


Fig 5 Body-Diode Characteristics

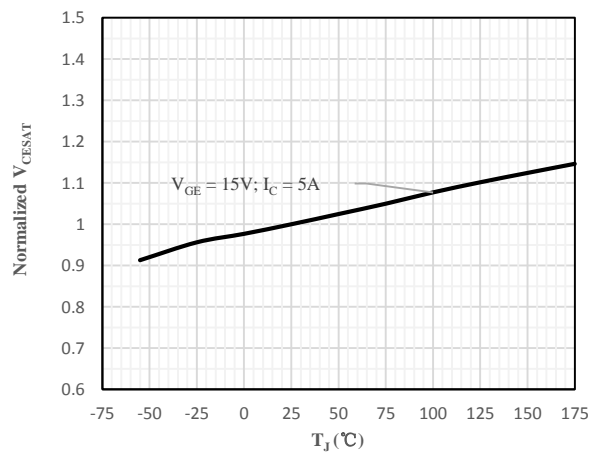


Fig 6 Normalized Collector-Emitter Saturation Voltage vs. Junction Temperature

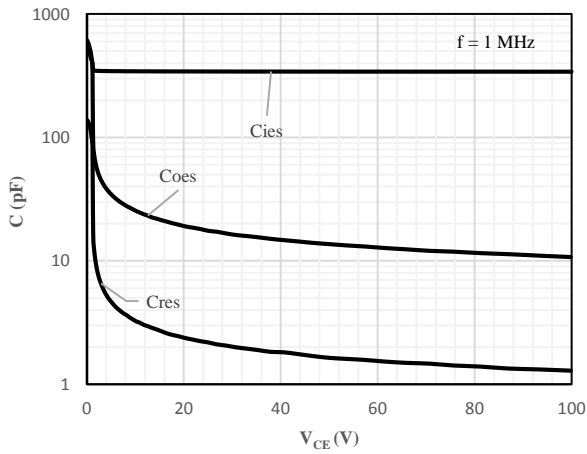


Fig 7 Capacitance Characteristics

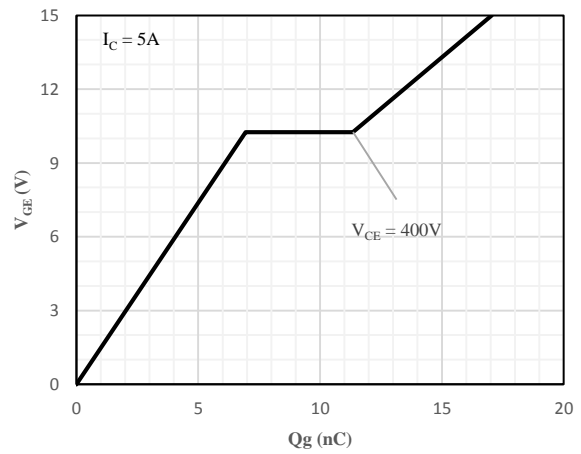


Fig 8 Gate-Charge Characteristics

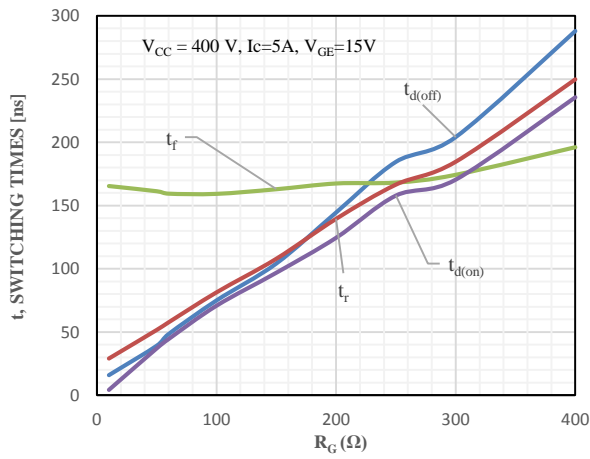


Fig 9 Switching Times vs. Gate Resistor

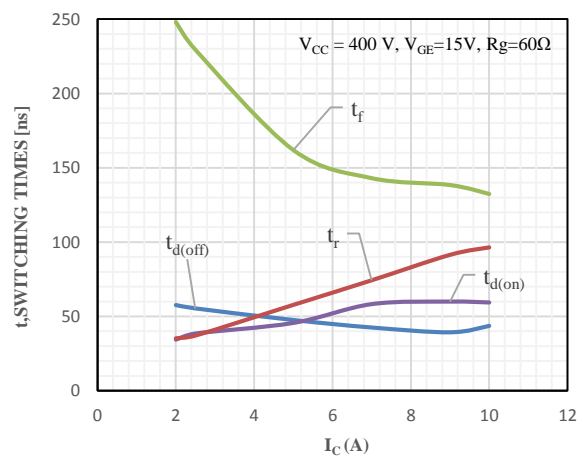


Fig 10 Switching Times vs. Collector Current

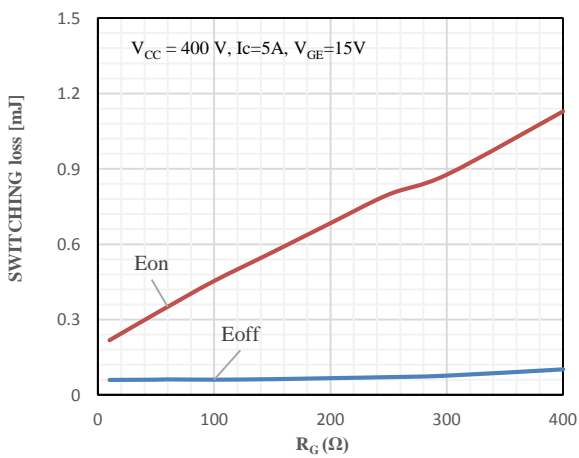


Fig 11 Switching Loss vs. Gate Resistor

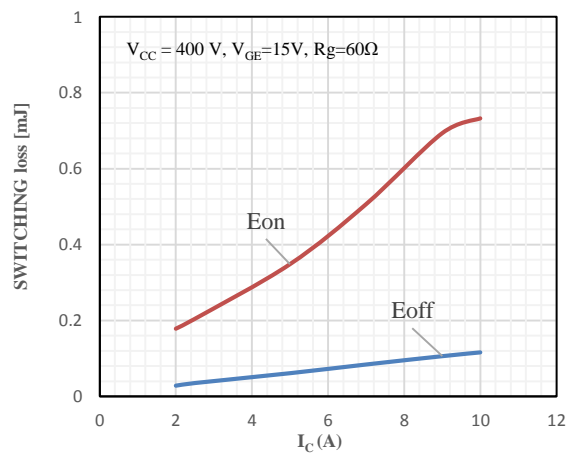


Fig 12 Switching Loss vs. Collector Current

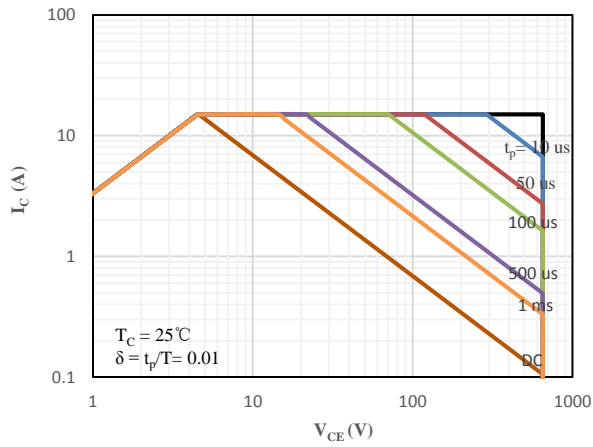


Fig 13 SOA characteristics

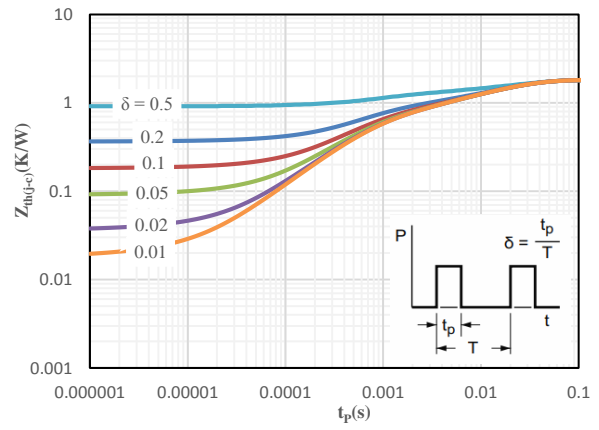
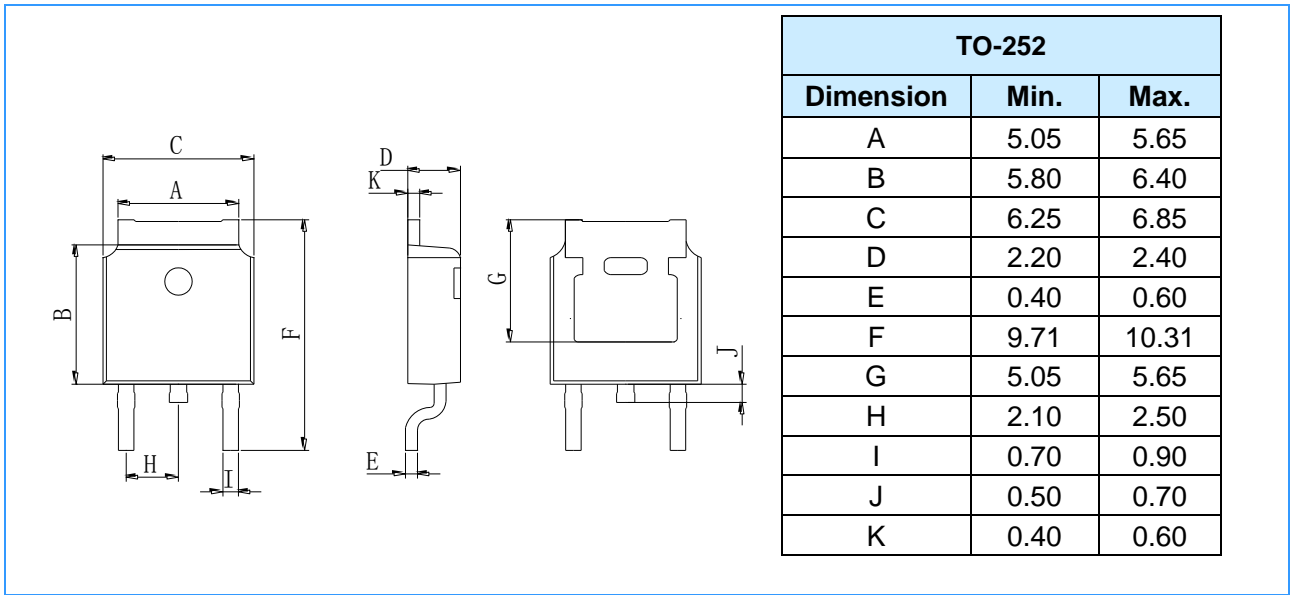
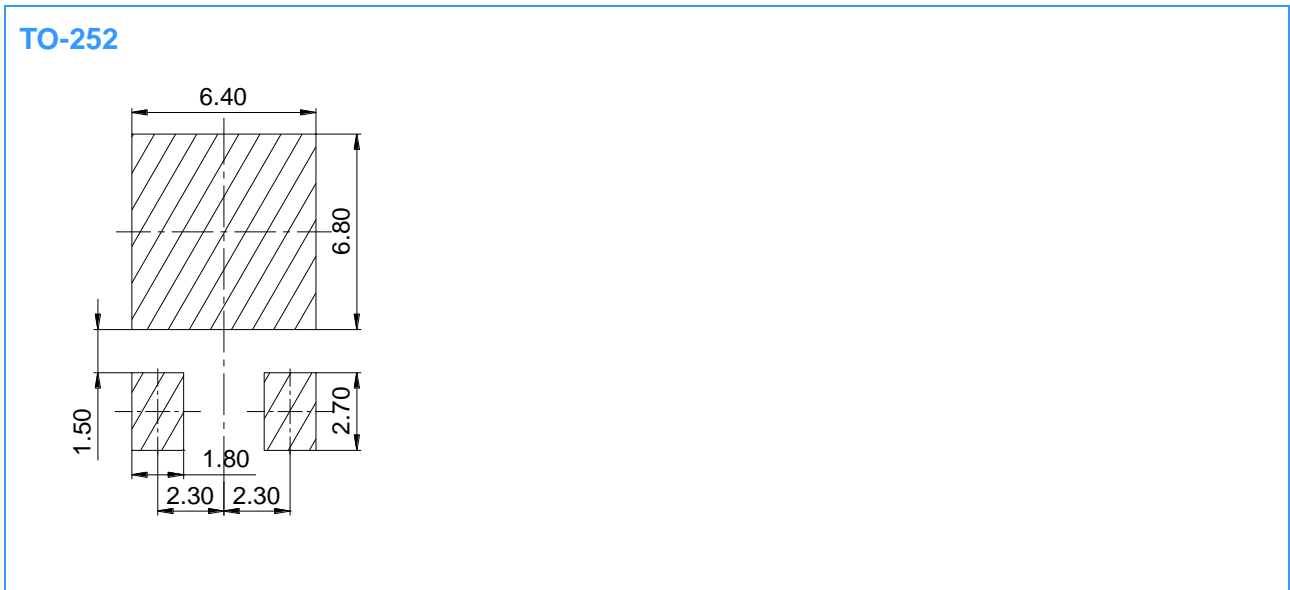


Fig 14 Maximum transient thermal impedance

**Package Outline Dimensions** (Unit: mm)



**Mounting Pad Layout** (Unit: mm)



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