$V_{BR(CES)}$ = 450 V, I_C = 20 A
N-channel Ignition IGBT

DGU4520GR

Data Sheet

Description

The DGU4520GR is 450 V IGBT with Zener diodes and gate resistors, and achieves an ignition coil drive circuit without an external clamped circuit. The IGBT has low saturation characteristic, and can improve the efficiency of the circuit.

Features

- AEC-Q101 Qualified
- Bare Lead Frame: Pb-free (RoHS Compliant)
- Built-in Zener Diodes
- Built-in Gate Resistors
- Low Saturation Voltage

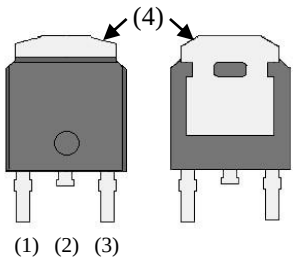
- $V_{(BR)CES}$ ---------- 450 V
- I_C ---------- 20 A
- $V_{CE(SAT)}$ ---------- 1.10 V typ. (V_{GE} = 4.5 V, I_C = 10 A)

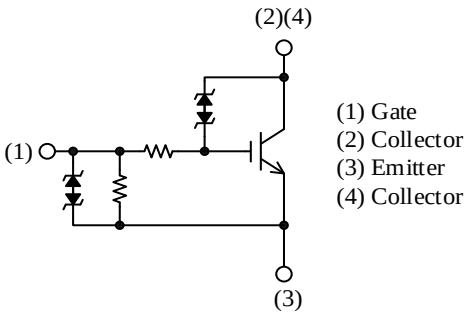
Applications

- Ignition Coil Driver Circuits

Packages

TO252-2L



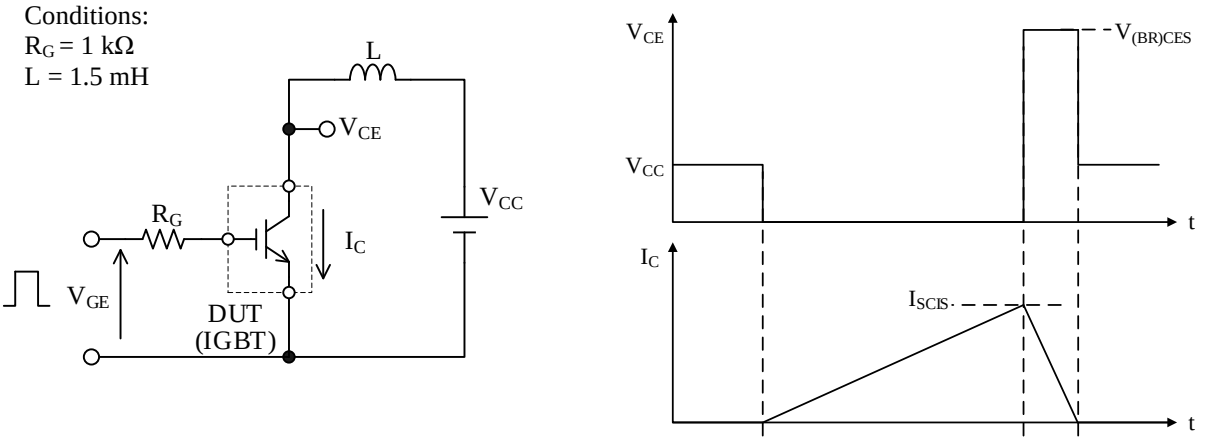


Not to scale

Absolute Maximum Ratings

Unless otherwise specified, T_A = 25 °C.

Parameter	Symbol	Conditions	Rating	Unit
Collector-to-Emitter Voltage	V_{CE}		$V_{(BR)CES}$	V
Gate-to-Emitter Voltage	V_{GE}		±10	V
Continuous Collector Current	I_C	T_C = 25 °C	20	A
Power Dissipation	P_D	T_C = 25 °C	172	W
Self-clamped Inductive Switching Energy	E_{SCIS}	See Figure 1 and Equation (1). V_{CC} = 14 V, V_{GE} = 5 V, L = 1.5 mH, R_G = 1 kΩ	300	mJ
Self-clamped Inductive Switching Current	I_{SCIS}		20	A
Reverse Avalanche Energy	$E_{AS(R)}$	L = 6 mH	2000	mJ
Operating Junction Temperature	T_J		−40 to 175	°C
Storage Temperature	T_{STG}		−40 to 175	°C



(a) Test Circuit (b) Waveform

Figure 1. Self-clamped Inductive Switching Energy Test

$$E_{SCIS} = \frac{1}{2} \times L \times {I_{SCIS}}^2 \times \frac{V_{(BR)CES}}{V_{(BR)CES} - V_{CC}} \quad (1)$$

Electrical Characteristics

Unless otherwise specified, T_A = 25 °C.

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Collector-to-Emitter Breakdown Voltage	$V_{(BR)CES}$	I_C = 2 mA, V_{GE} = 0 V		425	450	475	V
Gate-to-Emitter Breakdown Voltage	$V_{(BR)GES}$	I_G = ±1 mA, V_{CE} = 0 V		±10.0	±11.5	±13.0	V
Collector-to-Emitter Leakage Current	I_{CES}	V_{CE} = 350 V, V_{GE} = 0 V		—	—	100	μA
Emitter-to-Collector Leakage Current	I_{ECS}	V_{EC} = 24 V		—	—	1.0	mA
Gate-to-Emitter Leakage Current	I_{GES}	V_{GE} = ±5 V		±89	±106	±132	μA
Gate Threshold Voltage	$V_{GE(TH)}$	V_{CE} = 10 V, I_C = 1 mA		1.40	1.75	2.10	V
Collector-to-Emitter Saturation Voltage	$V_{CE(SAT)}$	T_J = 25 °C	V_{GE} = 3.5 V, I_C = 10 A	—	1.16	1.39	V
			V_{GE} = 4.5 V, I_C = 10 A	—	1.10	1.32	V
			V_{GE} = 4.5 V, I_C = 15 A	—	1.25	1.50	V
			V_{GE} = 4.5 V, I_C = 20 A	—	1.39	1.67	V
		T_J = 150 °C	V_{GE} = 3.5 V, I_C = 10 A	—	1.15	1.50	V
			V_{GE} = 4.5 V, I_C = 10 A	—	1.08	1.40	V
			V_{GE} = 4.5 V, I_C = 15 A	—	1.31	1.77	V
			V_{GE} = 4.5 V, I_C = 20 A	—	1.58	2.13	V
Input Capacitance	C_{ies}	V_{CE} = 10 V, V_{GE} = 0 V, f = 1.0 MHz		—	1900	—	pF
Output Capacitance	C_{oes}			—	460	—	pF
Reverse Transfer Capacitance	C_{res}			—	160	—	pF
Turn-on Delay Time	$t_{d(ON)}$	Resistive load, see Figure 3		—	1.3	—	μs
Rise Time	t_r			—	3.8	—	μs
Turn-off Delay Time	$t_{d(OFF)}$	Inductive load, see Figure 4		—	13.5	—	μs
Fall Time	t_f			—	2.7	—	μs
Internal Series Gate Resistor[1]	$R_{G(INT)}$			—	70	—	Ω
Internal Gate-to-Emitter Resistor [1]	$R_{GE(INT)}$	T_J = −40 to 175 °C		37.6	47.0	61.1[2]	kΩ

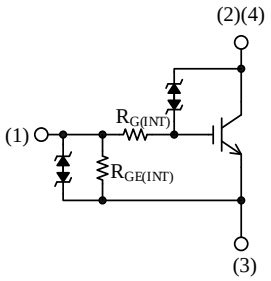


Figure 2. Internal Gate Resistor

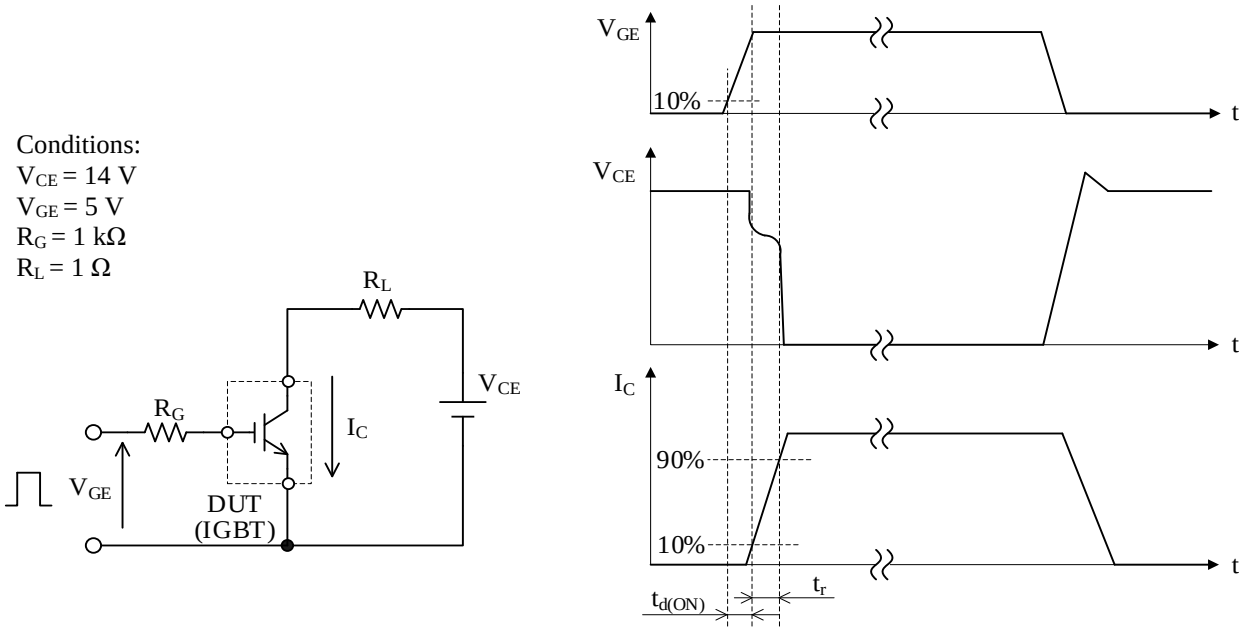
[1] See Figure 2
[2] Guaranteed by design.

Thermal Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Thermal Resistance (Junction-to-Case)	$R_{\theta JC}$		—	—	0.87	°C/W

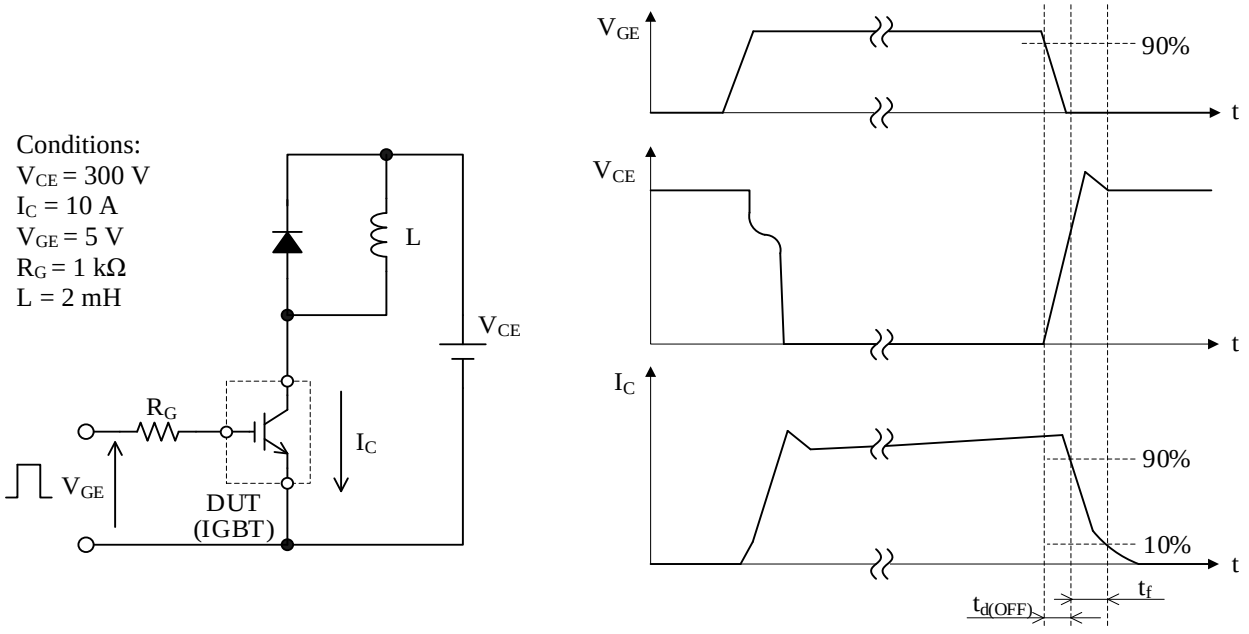
Mechanical Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Unit
Package Weight		—	0.32	—	g



(a) Test Circuit (b) Waveform

Figure 3. Switching Time Test in Resistive Load



(a) Test Circuit (b) Waveform

Figure 4. Switching Time Test in Inductive Load

Rating and Typical Characteristic Curves

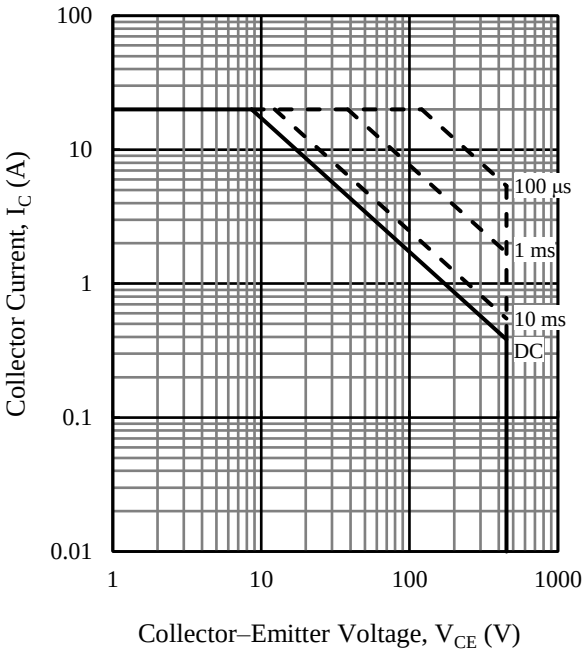


Figure 5. Safe Operating Area

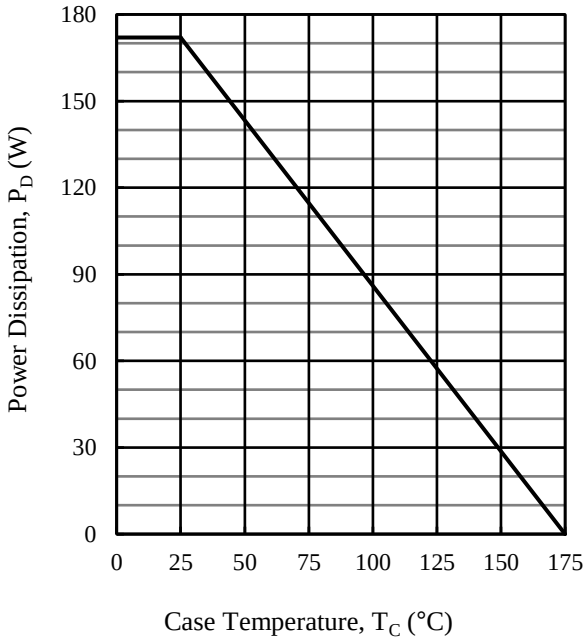


Figure 6. Typical Characteristics: P_D vs. T_C

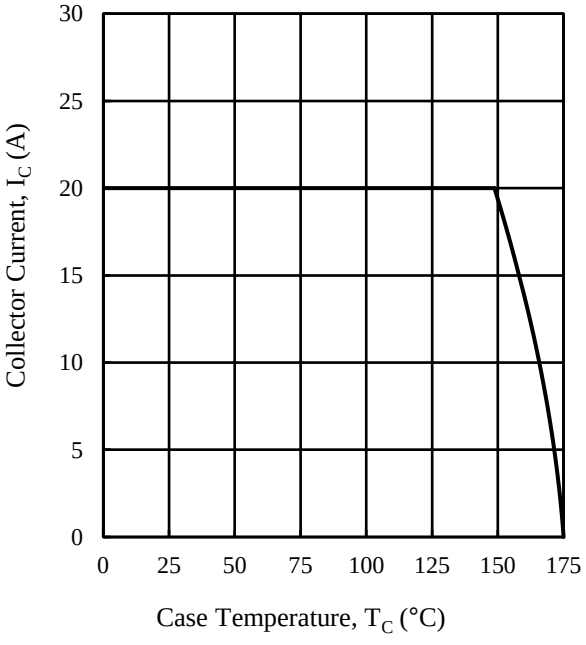


Figure 7. Typical Characteristics: I_C vs. T_C (V_{GE} = 5 V)

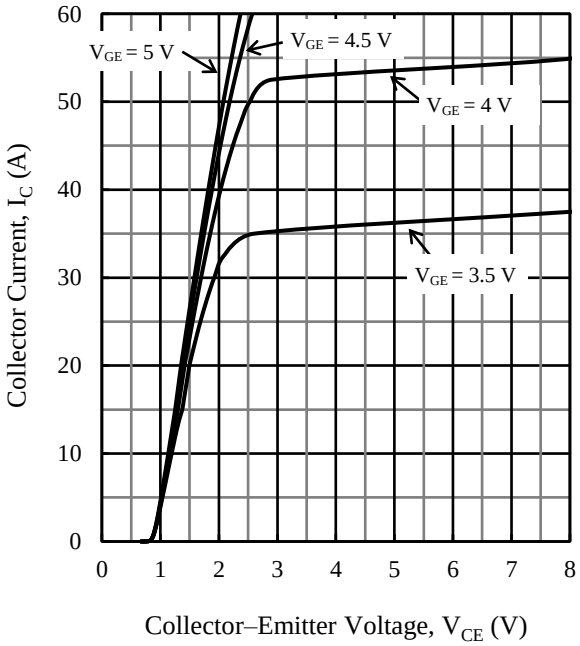


Figure 8. Typical Characteristics: I_C vs. V_{CE} (T_J = −40 °C)

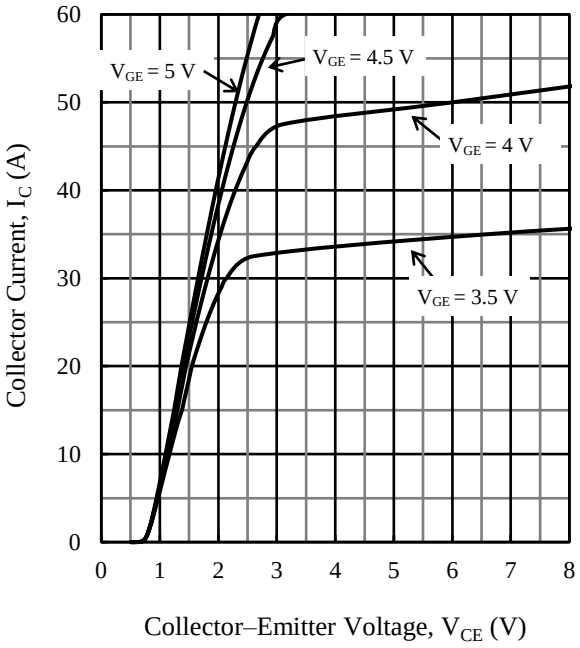


Figure 9. Typical Characteristics: I_C vs. V_{CE} (T_J = 25 °C)

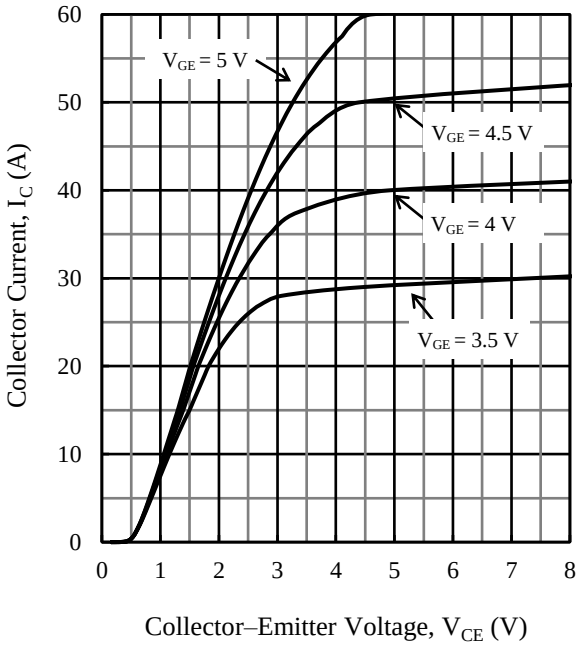


Figure 10. Typical Characteristics: I_C vs. V_{CE} (T_J = 175 °C)

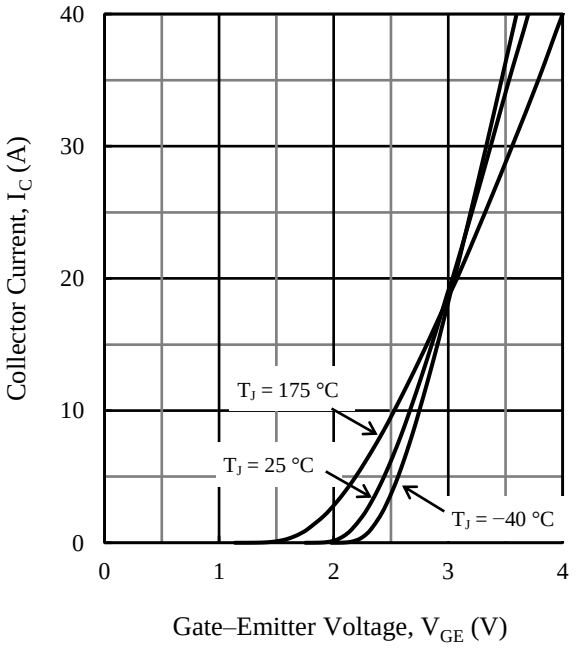


Figure 11. Typical Characteristics: I_C vs. V_{GE} (V_{CE} = 5 V)

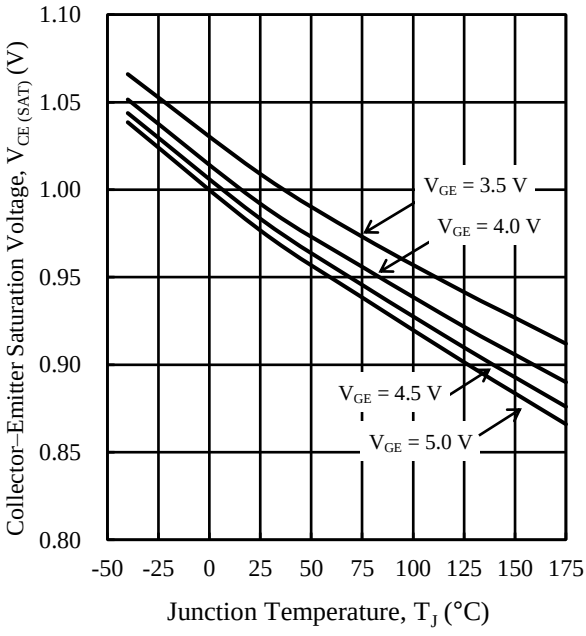


Figure 12. Typical Characteristics: $V_{CE(SAT)}$ vs. T_J (I_C = 6 A)

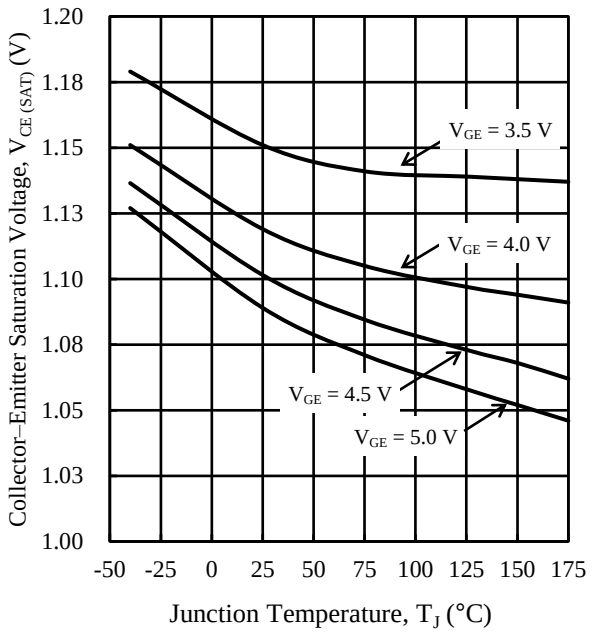


Figure 13. Typical Characteristics: $V_{CE(SAT)}$ vs. T_J (I_C = 10 A)

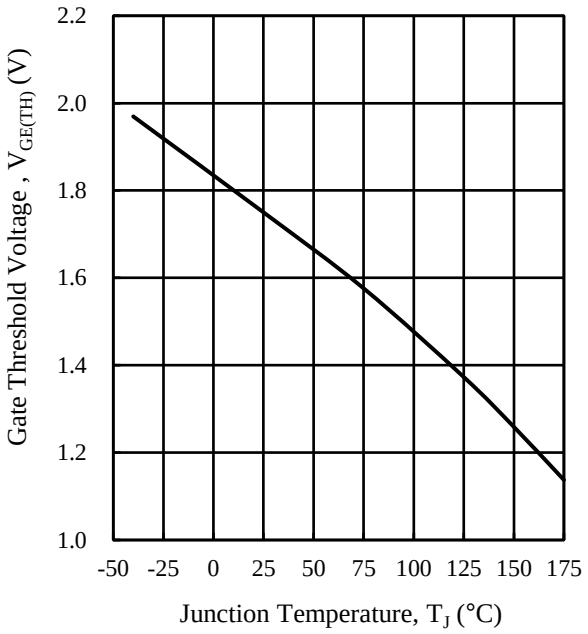


Figure 14. Typical Characteristics: $V_{GE(TH)}$ vs. T_J (V_{CE} = 10 V, I_C = 1 mA)

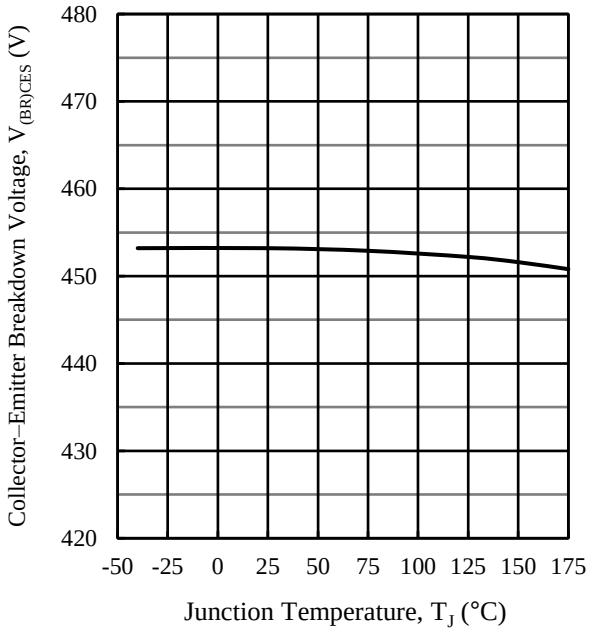


Figure 15. Typical Characteristics: $V_{(BR)CES}$ vs. T_J (V_{GE} = 0 V, I_C = 2 mA)

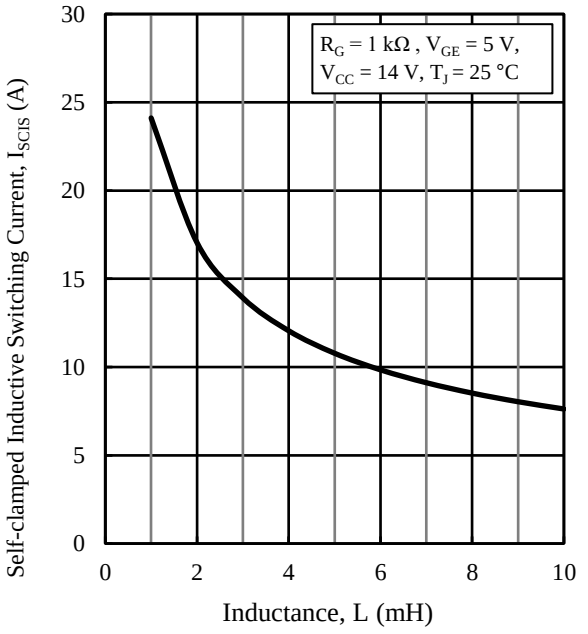


Figure 16. Typical Characteristics: I_{SCIS} vs. L

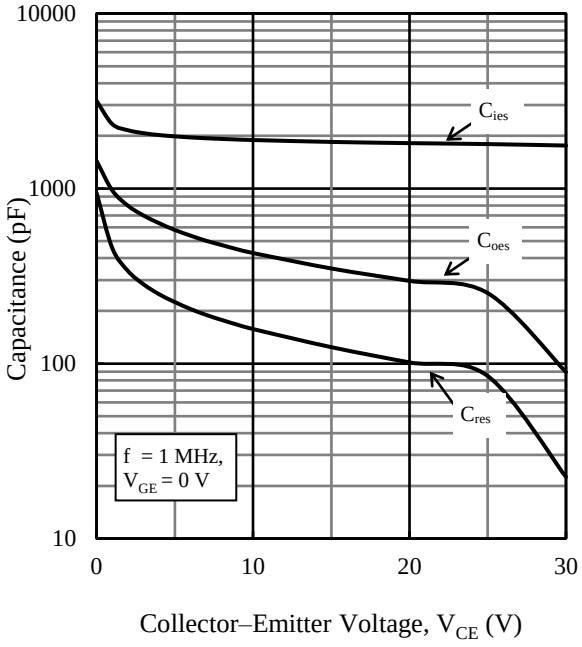


Figure 17. Typical Characteristics: Capacitance vs. V_{CE}

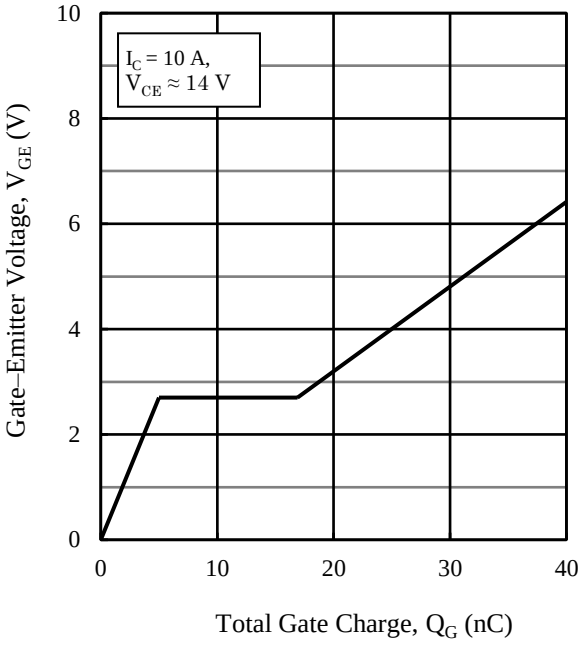


Figure 18. Typical Characteristics: V_{GE} vs. Q_G

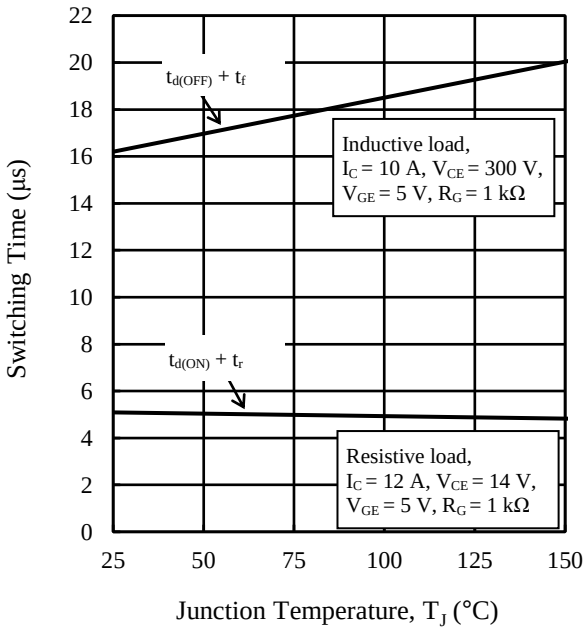


Figure 19. Typical Characteristics: Switching Time vs. T_J

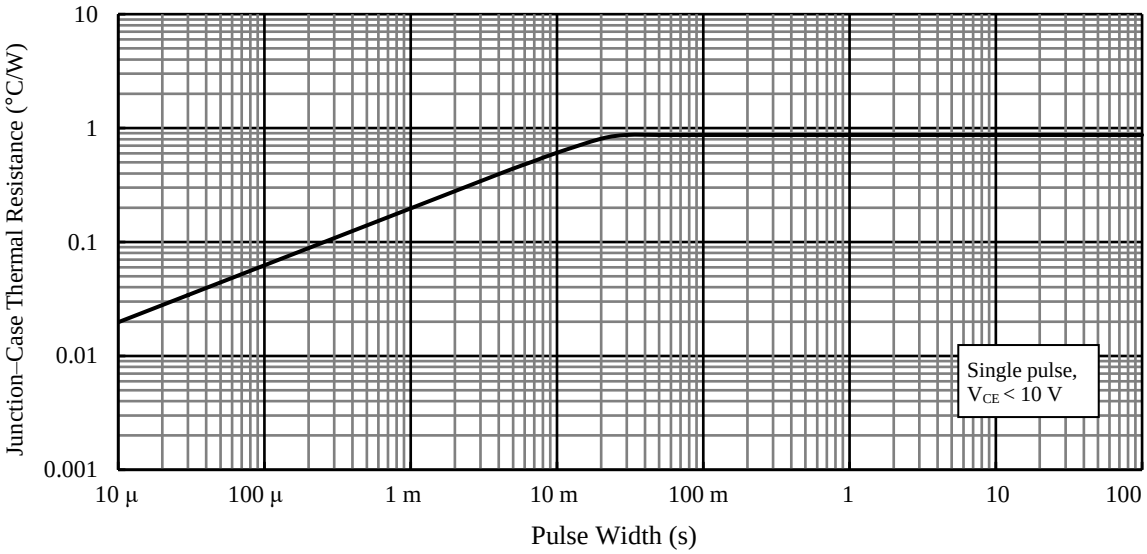
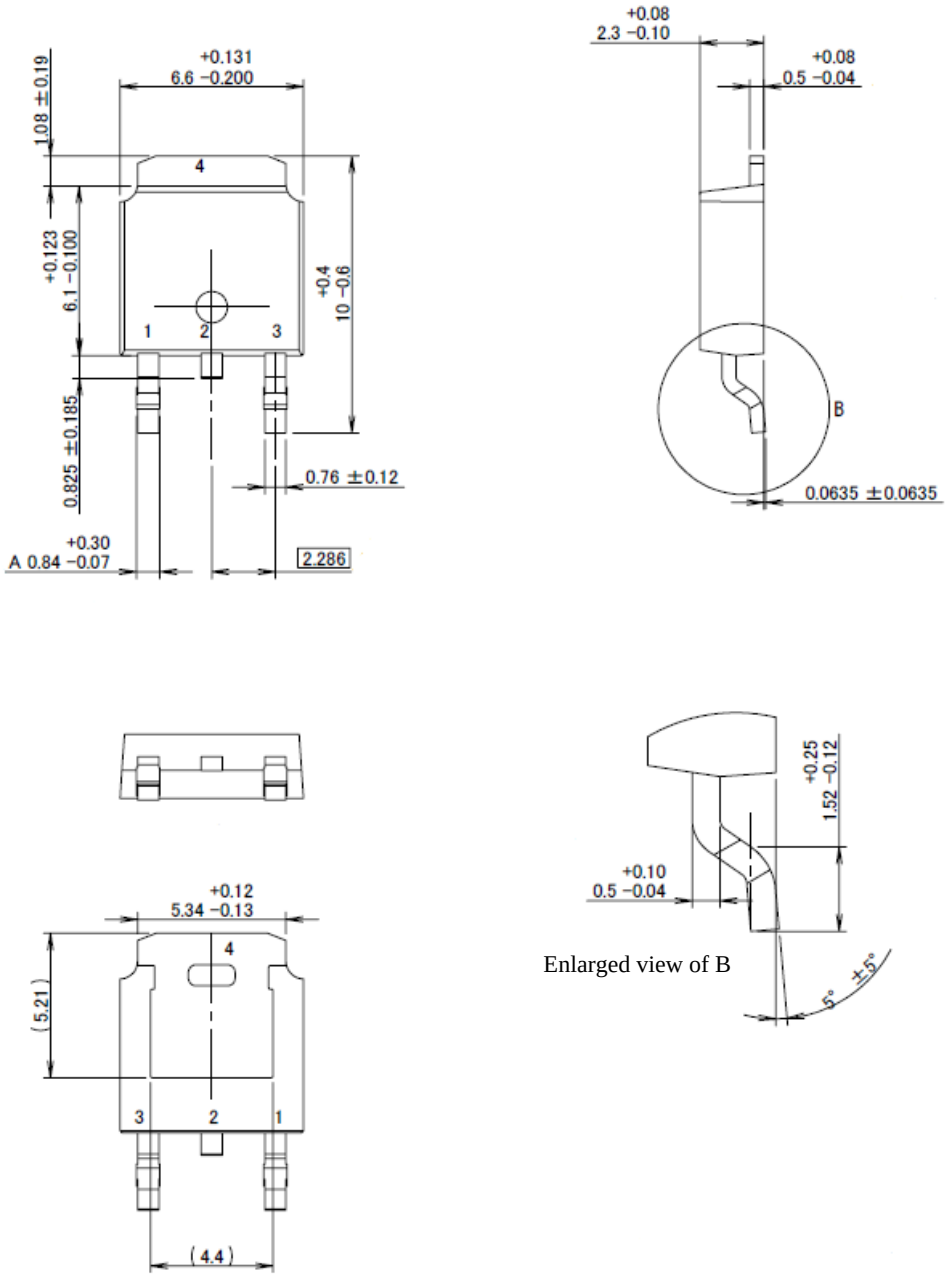


Figure 20. Typical Transient Thermal Resistance Characteristics

Physical Dimensions

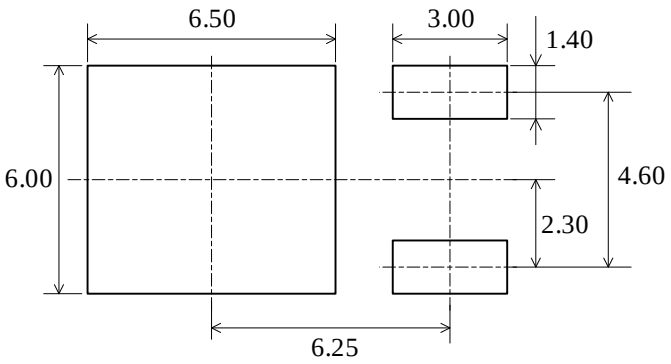
● **TO252-2L Package**



NOTES:

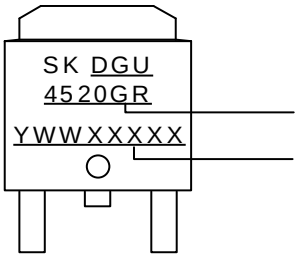
- Dimensions in millimeters
- All the dimensions exclude mold flashes, protrusions, and gate burrs.
- Bare lead frame: Pb-free (RoHS compliant)
- Moisture Sensitivity Level 1 (MSL 1)
- When soldering the products, it is required to minimize the working time within the following limits:
  Reflow
  Preheat: 150 °C to 200 °C / 60 s to 120 s
  Solder heating: 255 °C / 30 s, 3 times (260 °C peak)
  Soldering iron: 350 °C / 3.5 s, 1 time

● **TO252-2L Land Pattern Example**



Dimensions in millimeters

Marking Diagram



Part Number

Lot Number:
Y is the last digit of the year of manufacture (0 to 9)
WW is Work Week
XXXXX is the control number

Important Notes

- All data, illustrations, graphs, tables and any other information included in this document (the "Information") as to Sanken's products listed herein (the "Sanken Products") are current as of the date this document is issued. The Information is subject to any change without notice due to improvement of the Sanken Products, etc. Please make sure to confirm with a Sanken sales representative that the contents set forth in this document reflect the latest revisions before use.
- The Sanken Products are intended for use as components of electronic equipment or apparatus (transportation equipment and its control systems, home appliances, office equipment, telecommunication equipment, measuring equipment, etc.). Prior to use of the Sanken Products, please put your signature, or affix your name and seal, on the specification documents of the Sanken Products and return them to Sanken. If considering use of the Sanken Products for any applications that require higher reliability (traffic signal control systems or equipment, disaster/crime alarm systems, etc.), you must contact a Sanken sales representative to discuss the suitability of such use and put your signature, or affix your name and seal, on the specification documents of the Sanken Products and return them to Sanken, prior to the use of the Sanken Products. The Sanken Products are not intended for use in any applications that require extremely high reliability such as: aerospace equipment; nuclear power control systems; and medical equipment or systems, whose failure or malfunction may result in death or serious injury to people, i.e., medical devices in Class III or a higher class as defined by relevant laws of Japan (collectively, the "Specific Applications"). Sanken assumes no liability or responsibility whatsoever for any and all damages and losses that may be suffered by you, users or any third party, resulting from the use of the Sanken Products in the Specific Applications or in manner not in compliance with the instructions set forth herein.
- In the event of using the Sanken Products by either (i) combining other products or materials or both therewith or (ii) physically, chemically or otherwise processing or treating or both the same, you must duly consider all possible risks that may result from all such uses in advance and proceed therewith at your own responsibility.
- Although Sanken is making efforts to enhance the quality and reliability of its products, it is impossible to completely avoid the occurrence of any failure or defect or both in semiconductor products at a certain rate. You must take, at your own responsibility, preventative measures including using a sufficient safety design and confirming safety of any equipment or systems in/for which the Sanken Products are used, upon due consideration of a failure occurrence rate and derating, etc., in order not to cause any human injury or death, fire accident or social harm which may result from any failure or malfunction of the Sanken Products. Please refer to the relevant specification documents and Sanken's official website in relation to derating.
- No anti-radioactive ray design has been adopted for the Sanken Products.
- The circuit constant, operation examples, circuit examples, pattern layout examples, design examples, recommended examples, all information and evaluation results based thereon, etc., described in this document are presented for the sole purpose of reference of use of the Sanken Products.
- Sanken assumes no responsibility whatsoever for any and all damages and losses that may be suffered by you, users or any third party, or any possible infringement of any and all property rights including intellectual property rights and any other rights of you, users or any third party, resulting from the Information.
- No information in this document can be transcribed or copied or both without Sanken's prior written consent.
- Regarding the Information, no license, express, implied or otherwise, is granted hereby under any intellectual property rights and any other rights of Sanken.
- Unless otherwise agreed in writing between Sanken and you, Sanken makes no warranty of any kind, whether express or implied, including, without limitation, any warranty (i) as to the quality or performance of the Sanken Products (such as implied warranty of merchantability, and implied warranty of fitness for a particular purpose or special environment), (ii) that any Sanken Product is delivered free of claims of third parties by way of infringement or the like, (iii) that may arise from course of performance, course of dealing or usage of trade, and (iv) as to the Information (including its accuracy, usefulness, and reliability).
- In the event of using the Sanken Products, you must use the same after carefully examining all applicable environmental laws and regulations that regulate the inclusion or use or both of any particular controlled substances, including, but not limited to, the EU RoHS Directive, so as to be in strict compliance with such applicable laws and regulations.
- You must not use the Sanken Products or the Information for the purpose of any military applications or use, including but not limited to the development of weapons of mass destruction. In the event of exporting the Sanken Products or the Information, or providing them for non-residents, you must comply with all applicable export control laws and regulations in each country including the U.S. Export Administration Regulations (EAR) and the Foreign Exchange and Foreign Trade Act of Japan, and follow the procedures required by such applicable laws and regulations.
- Sanken assumes no responsibility for any troubles, which may occur during the transportation of the Sanken Products including the falling thereof, out of Sanken's distribution network.
- Although Sanken has prepared this document with its due care to pursue the accuracy thereof, Sanken does not warrant that it is error free and Sanken assumes no liability whatsoever for any and all damages and losses which may be suffered by you resulting from any possible errors or omissions in connection with the Information.
- Please refer to our official website in relation to general instructions and directions for using the Sanken Products, and refer to the relevant specification documents in relation to particular precautions when using the Sanken Products.
- All rights and title in and to any specific trademark or tradename belong to Sanken and such original right holder(s).

DSGN-AEZ-16003