$V_{BR(CES)}$ = 400 V, I_C = 20 A
N-channel Ignition IGBT

DGU4020GR

Data Sheet

Description

The DGU4020GR is 400 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

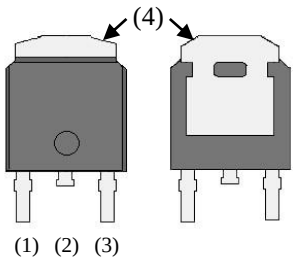
- $V_{(BR)CES}$ ---------- 400 V
- I_C ---------- 20 A
- $V_{CE(SAT)}$ ---------- 1.10 V typ. (V_{GE} = 4.5 V, I_C = 10 A)

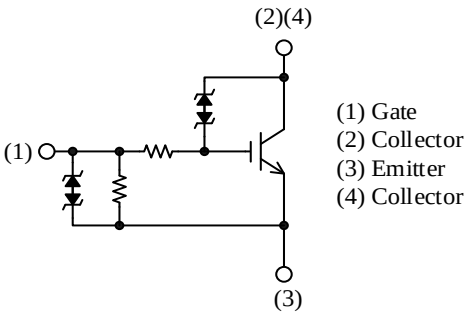
Applications

- Ignition Coil Driver Circuits

Packages

TO252-2L



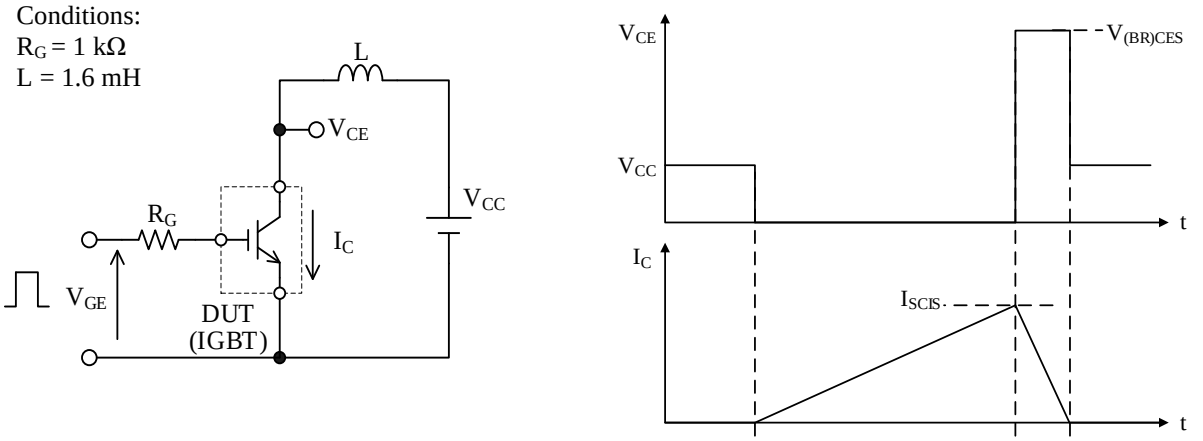


Not to scale

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 = 1.6 mH, R_G = 1 kΩ	320	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		375	400	425	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} = 300 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

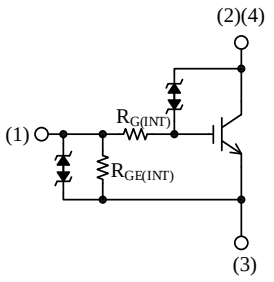


Figure 2. Internal Gate Resistor

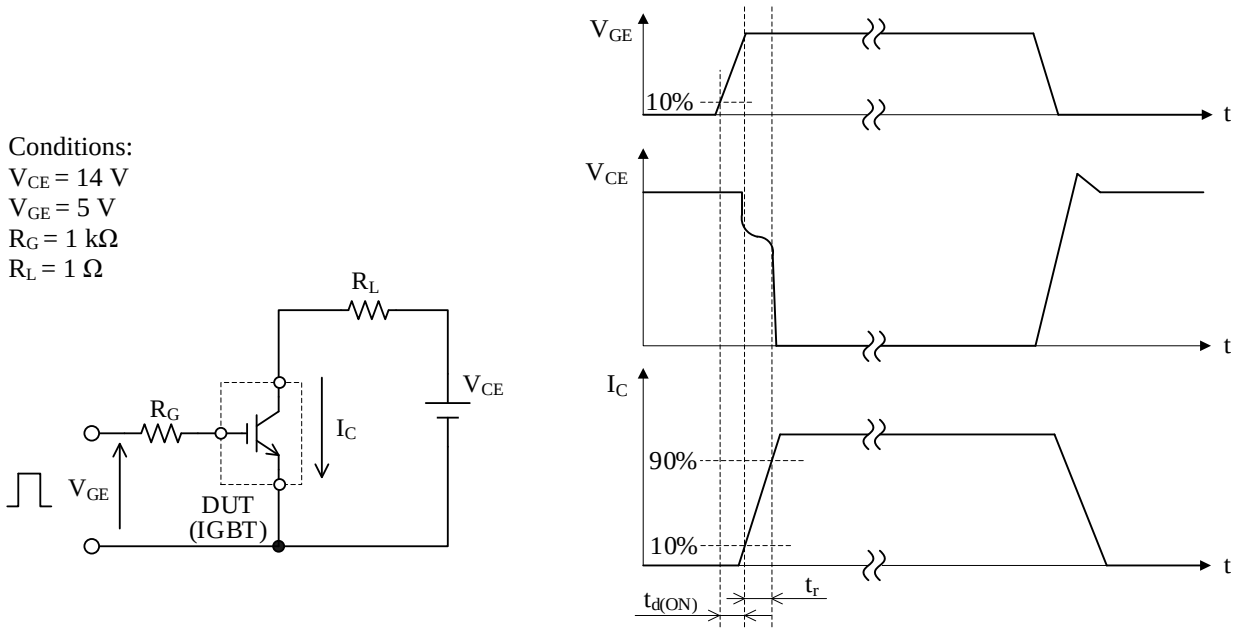
[1] See Figure 2.
[2] Guaranteed by design.

Thermal Characteristics

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

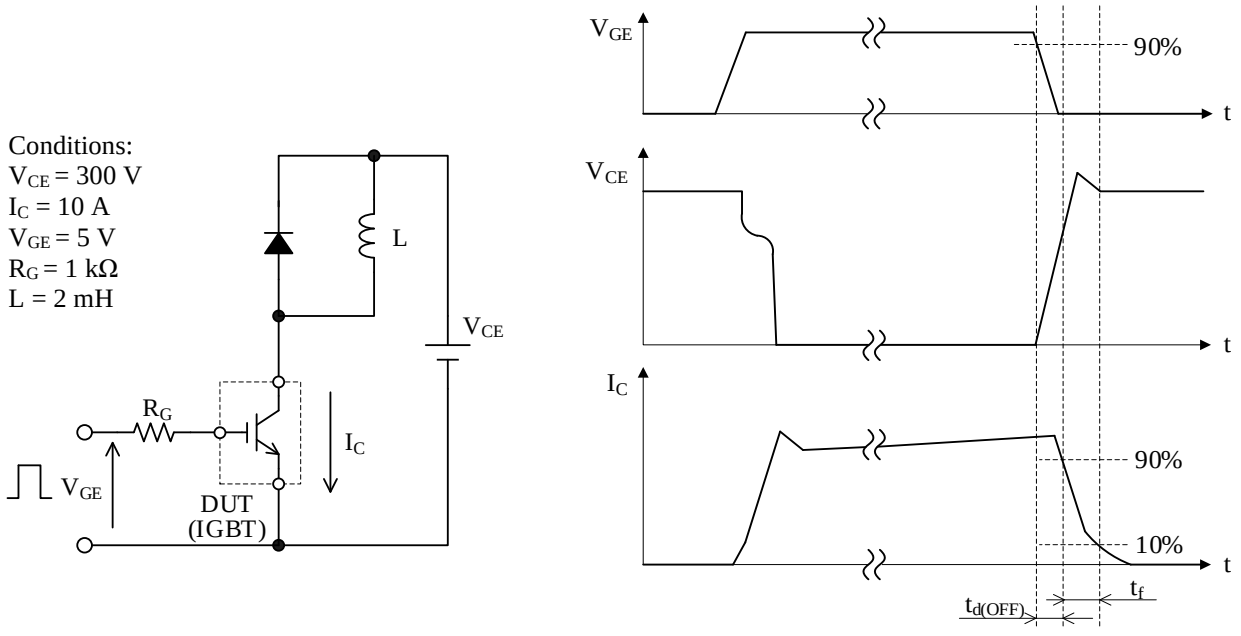
Mechanical Characteristics

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

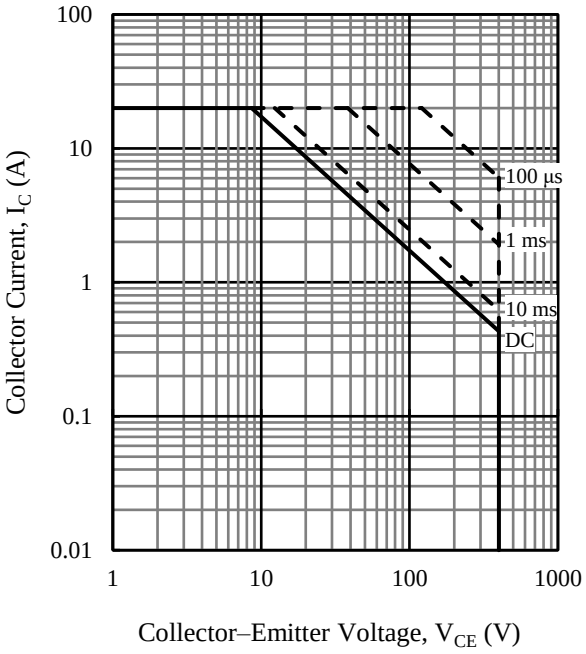


Figure 5. Safe Operating Area

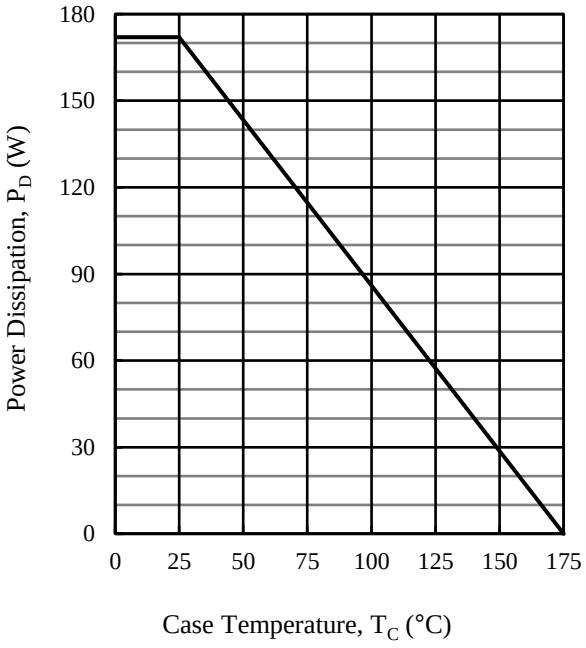


Figure 6. Typical Characteristics: P_D vs. T_C

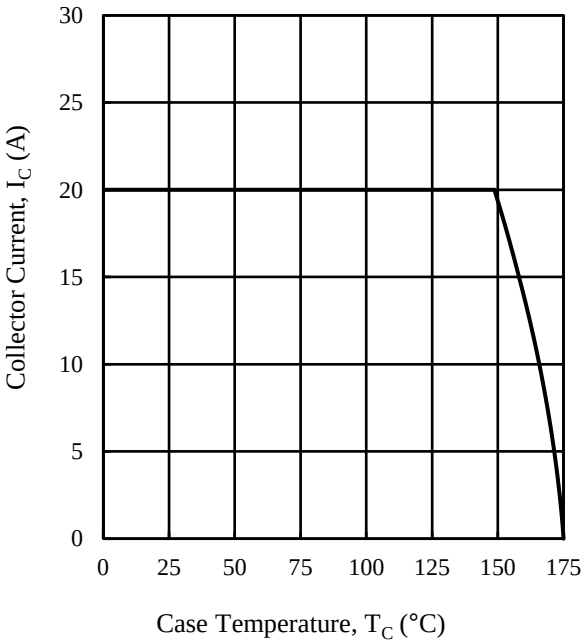


Figure 7. Typical Characteristics: I_C vs. T_C (V_{GE} = 5 V)

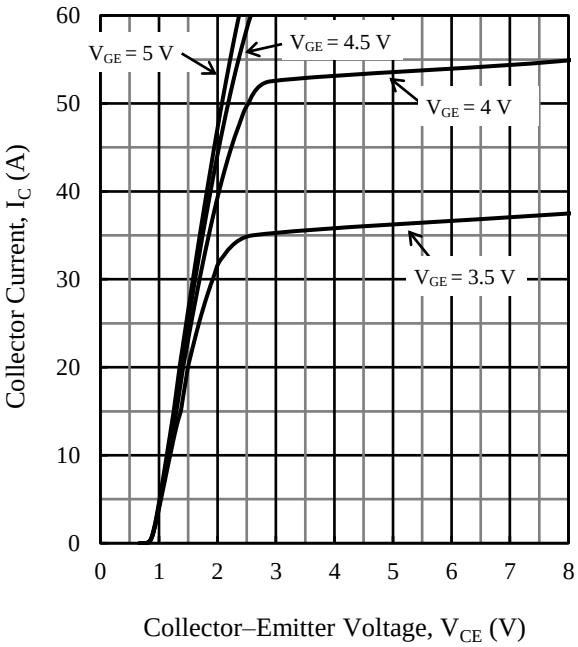


Figure 8. Typical Characteristics: I_C vs. V_{CE} (T_J = −40 °C)

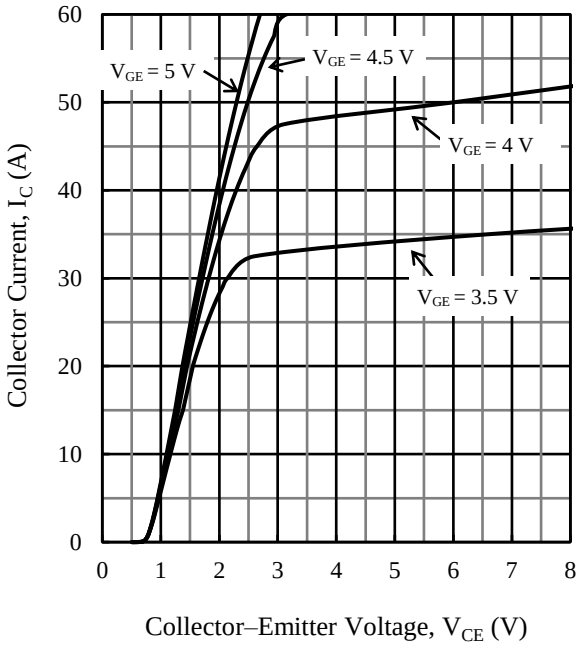


Figure 9. Typical Characteristics: I_C vs. V_{CE} (T_J = 25 °C)

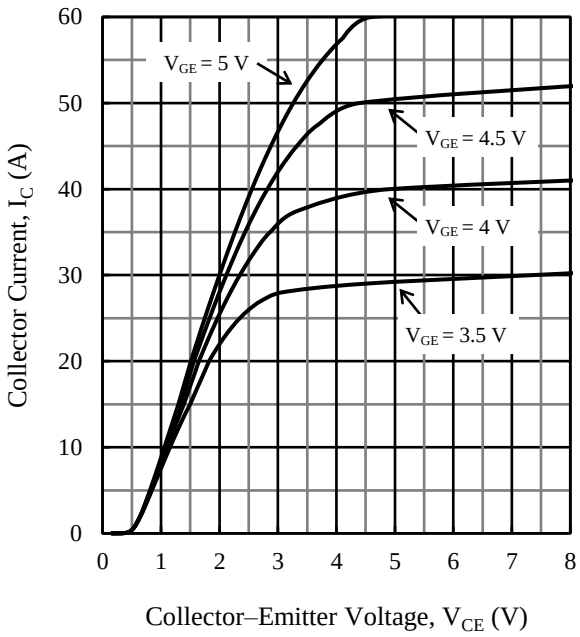


Figure 10. Typical Characteristics: I_C vs. V_{CE} (T_J = 175 °C)

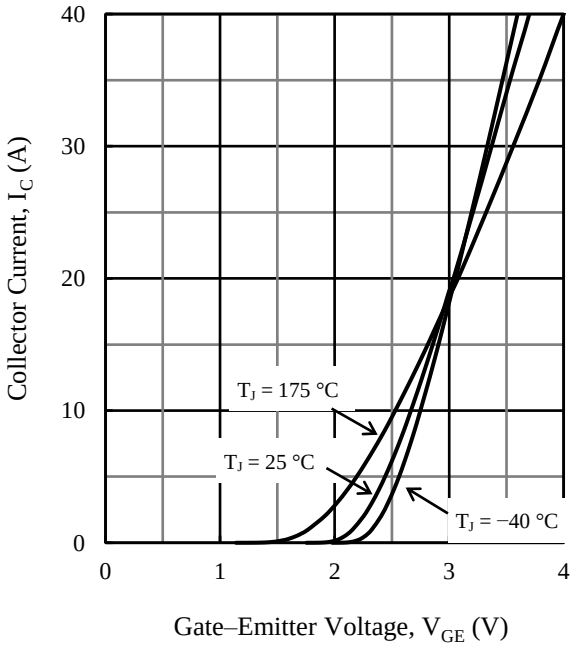


Figure 11. Typical Characteristics: I_C vs. V_{GE} (V_{CE} = 5 V)

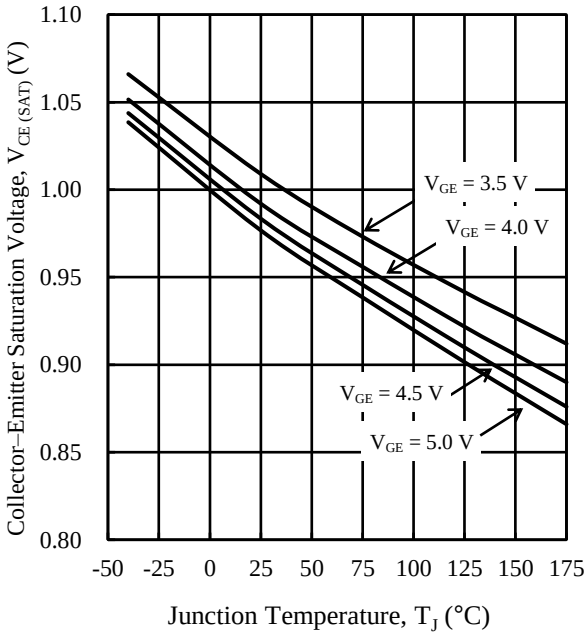


Figure 12. Typical Characteristics: $V_{CE(SAT)}$ vs. T_J (I_C = 6 A)

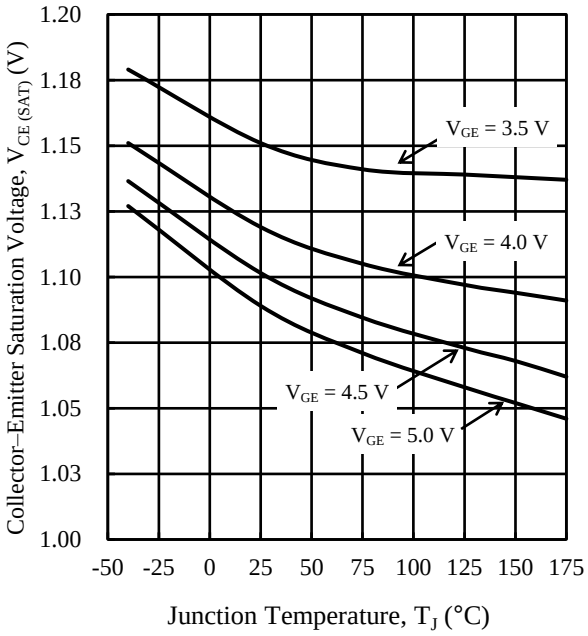


Figure 13. Typical Characteristics: $V_{CE(SAT)}$ vs. T_J (I_C = 10 A)

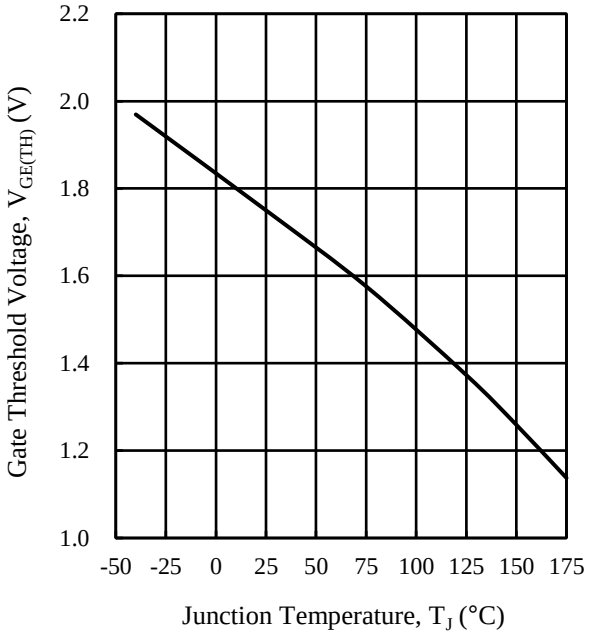


Figure 14. Typical Characteristics: $V_{GE(TH)}$ vs. T_J (V_{CE} = 10 V, I_C = 1 mA)

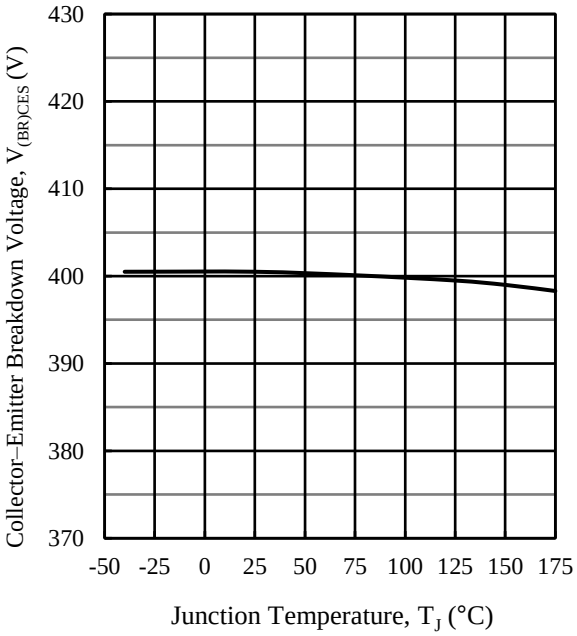


Figure 15. Typical Characteristics: $V_{(BR)CES}$ vs. T_J (V_{CE} = 0 V, I_C = 2 mA)

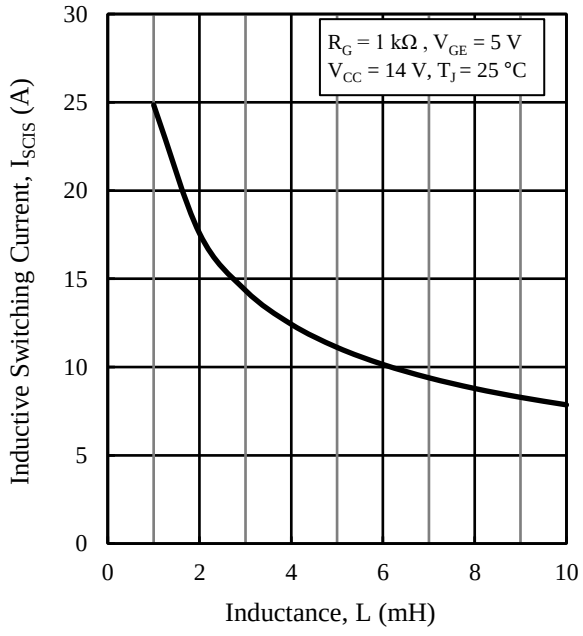


Figure 16. Typical Characteristics: I_{SCIS} vs. L

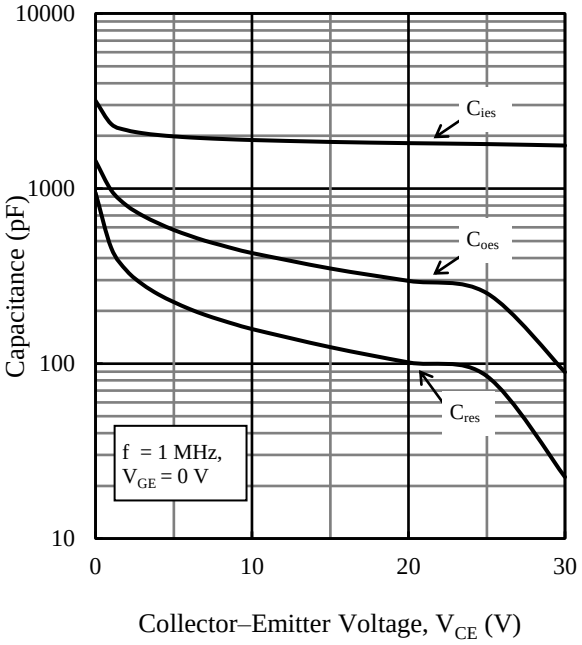


Figure 17. Typical Characteristics: Capacitance vs. V_{CE}

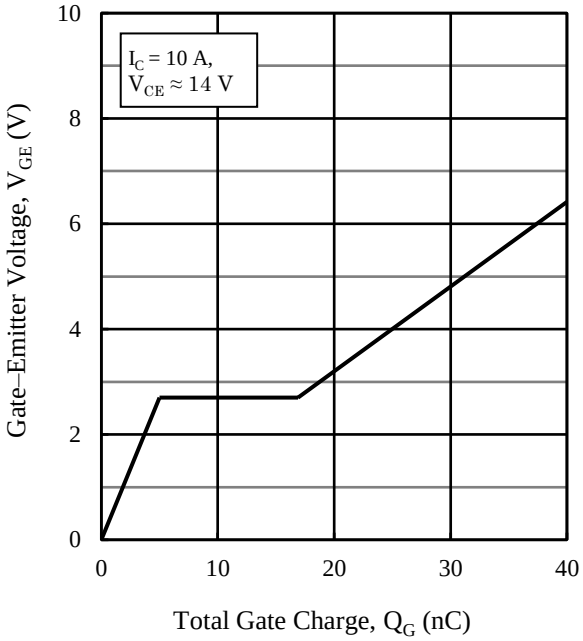


Figure 18. Typical Characteristics: V_{GE} vs. Q_G

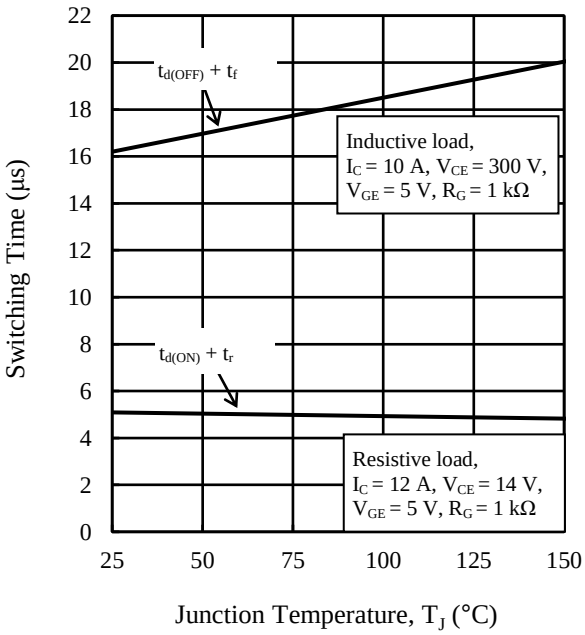


Figure 19. Typical Characteristics: Switching Time vs. T_J

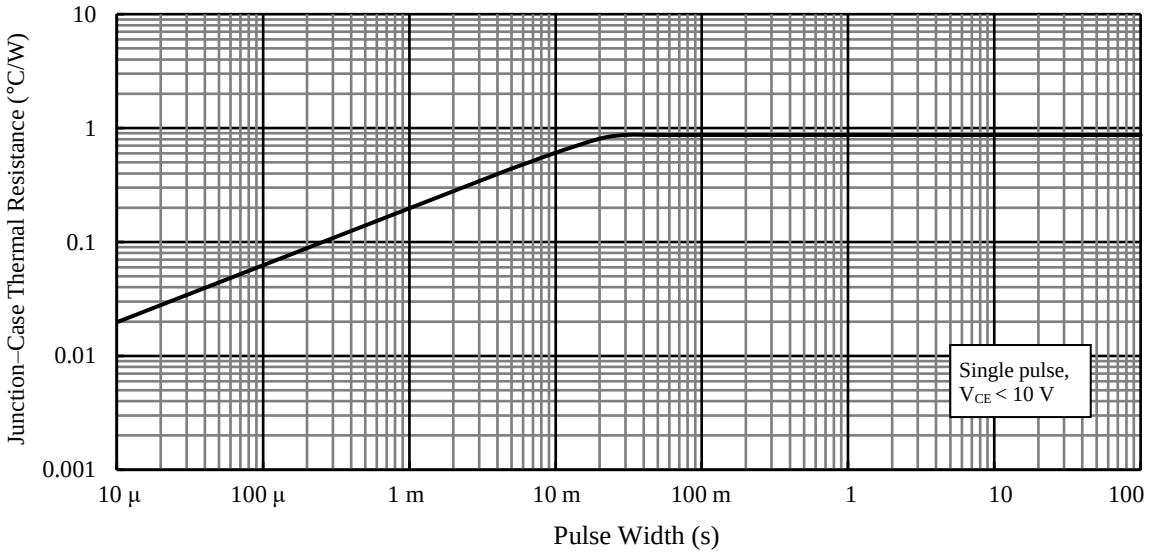
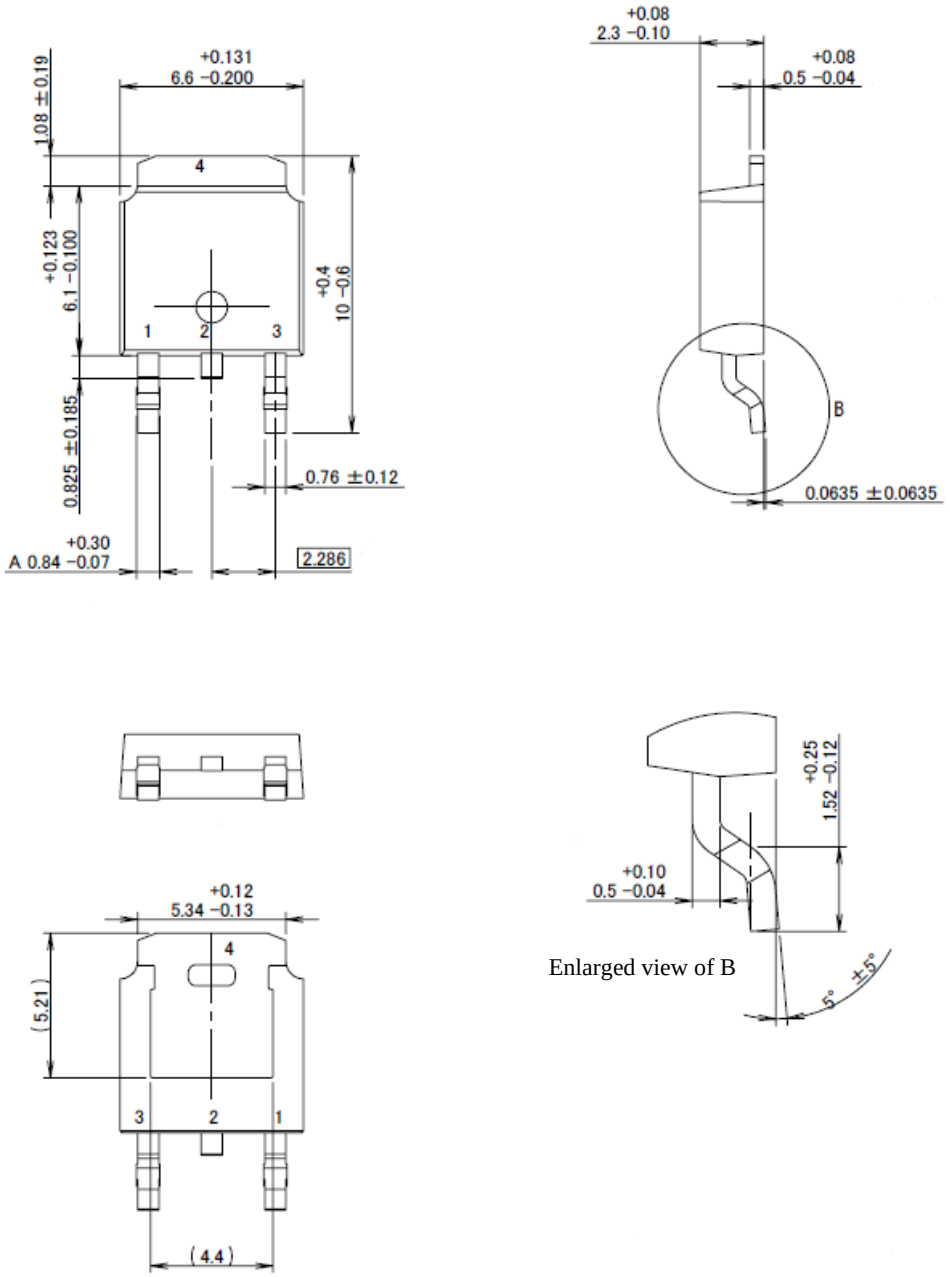


Figure 20. Typical Transient Thermal Resistance Characteristics

Physical Dimensions

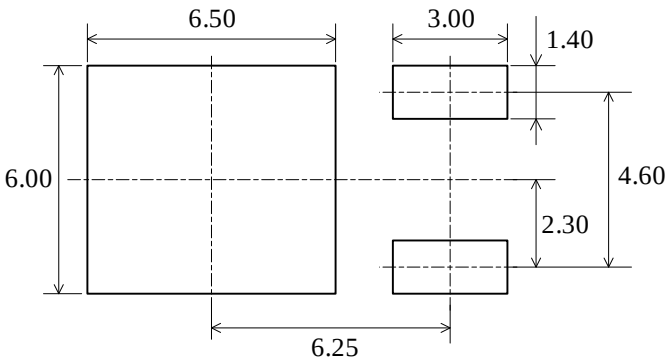
● **TO252-2L Package**



NOTES:

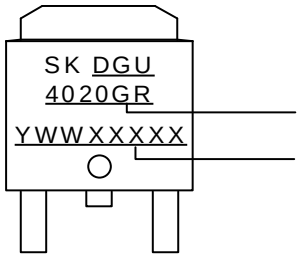
- Dimensions in millimeters
- All the dimensions exclude mold flashes, protrusions, and gate burrs.
- Bare lead frame: Pb-free (RoHS compliant)
- Moisture Sensitivity Level 1 (MSL 1)
- When soldering the products, it is required to minimize the working time within the following limits:
  Reflow
  Preheat: 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

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