

$V_{BR(CES)} = 400\text{ V}$, $I_C = 15\text{ A}$
N-channel Ignition IGBT
DGU4015G

Description

The DGU4015G 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

- Suitable for High Reliability and Automotive Requirement
- Bare Lead Frame: Pb-free (RoHS Compliant)
- Built-in Zener Diodes
- Built-in Gate Resistors
- Low Saturation Voltage

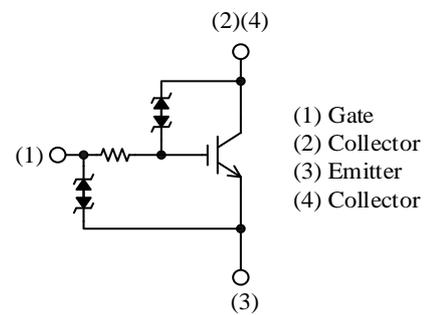
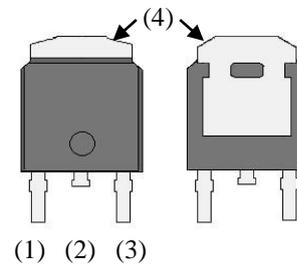
- $V_{(BR)CES}$ ----- 400 V
- I_C ----- 15 A
- $V_{CE(SAT)}$ ----- 1.4 V typ. ($V_{GE} = 4.5\text{ V}$, $I_C = 10\text{ A}$)

Applications

- Ignition Coil Driver Circuits

Package

TO252-2L



Not to scale

Absolute Maximum Ratings

Unless otherwise specified, $T_A = 25\text{ }^\circ\text{C}$.

Parameter	Symbol	Conditions	Rating	Unit
Collector-to-Emitter Voltage	V_{CE}		CLAMPED	V
Gate-to-Emitter Voltage	V_{GE}		± 10	V
Continuous Collector Current	I_C	$T_C = 25\text{ }^\circ\text{C}$	15	A
Power Dissipation	P_D	$T_C = 25\text{ }^\circ\text{C}$	60	W
Self-clamped Inductive Switching Energy	E_{SCIS}	See Figure 1 and Equation (1).	150	mJ
Operating Junction Temperature	T_J		-55 to 175	$^\circ\text{C}$
Storage Temperature	T_{STG}		-55 to 175	$^\circ\text{C}$

Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
External Gate Resistor	R_G		200	—	—	Ω

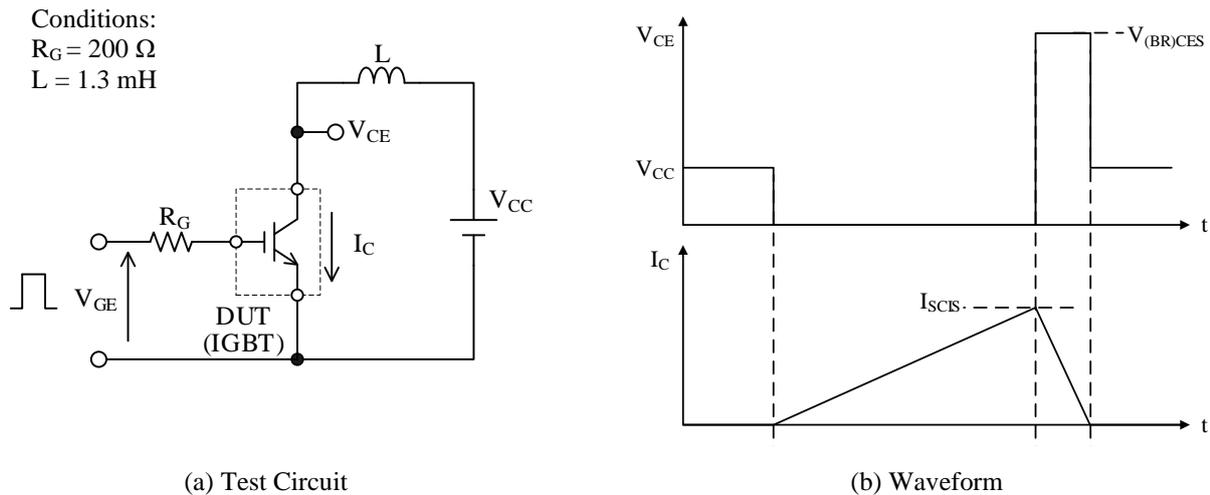


Figure 1. Self-clamped Inductive Switching Energy Test

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

Electrical Characteristics

 Unless otherwise specified, $T_A = 25\text{ }^\circ\text{C}$.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Collector-to-Emitter Breakdown Voltage	$V_{(BR)CES}$	$I_C = 2\text{ mA}$, $V_{GE} = 0\text{ V}$	375	400	425	V
Gate-to-Emitter Breakdown Voltage	$V_{(BR)GES}$	$I_G = \pm 1\text{ mA}$, $V_{CE} = 0\text{ V}$	± 10.0	± 11.5	± 13.0	V
Emitter-to-Collector Breakdown Voltage	$V_{(BR)ECS}$	$I_{EC} = 10\text{ mA}$, $V_{GE} = 0\text{ V}$	20	—	—	V
Collector-to-Emitter Leakage Current	I_{CES}	$V_{CE} = 300\text{ V}$, $V_{GE} = 0\text{ V}$	—	—	100	μA
Gate-to-Emitter Leakage Current	I_{GES}	$V_{GE} = \pm 5\text{ V}$	—	—	± 1.0	μA
Gate Threshold Voltage	$V_{GE(TH)}$	$V_{CE} = 10\text{ V}$, $I_C = 1\text{ mA}$	1.4	1.8	2.2	V
Collector-to-Emitter Saturation Voltage	$V_{CE(SAT)}$	$V_{GE} = 4.5\text{ V}$, $I_C = 5\text{ A}$	—	1.1	1.4	V
		$V_{GE} = 4.5\text{ V}$, $I_C = 10\text{ A}$	—	1.4	1.7	V
Input Capacitance	C_{ies}	$V_{CE} = 10\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1.0\text{ MHz}$	—	910	—	pF
Output Capacitance	C_{oes}		—	250	—	pF
Reverse Transfer Capacitance	C_{res}		—	75	—	pF
Turn-on Delay Time	$t_{d(ON)}$	Resistive load, see Figure 2	—	0.7	—	μs
Rise Time	t_r		—	2.1	—	μs
Turn-off Delay Time	$t_{d(OFF)}$	Inductive load, see Figure 3	—	6.7	—	μs
Fall Time	t_f		—	3.6	—	μs
Internal Gate Resistor	$R_{G(INT)}$		—	70	—	Ω

Thermal Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Thermal Resistance (Junction-to-Case)	$R_{\theta JC}$		—	—	2.5	$^\circ\text{C/W}$

Mechanical Characteristics

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

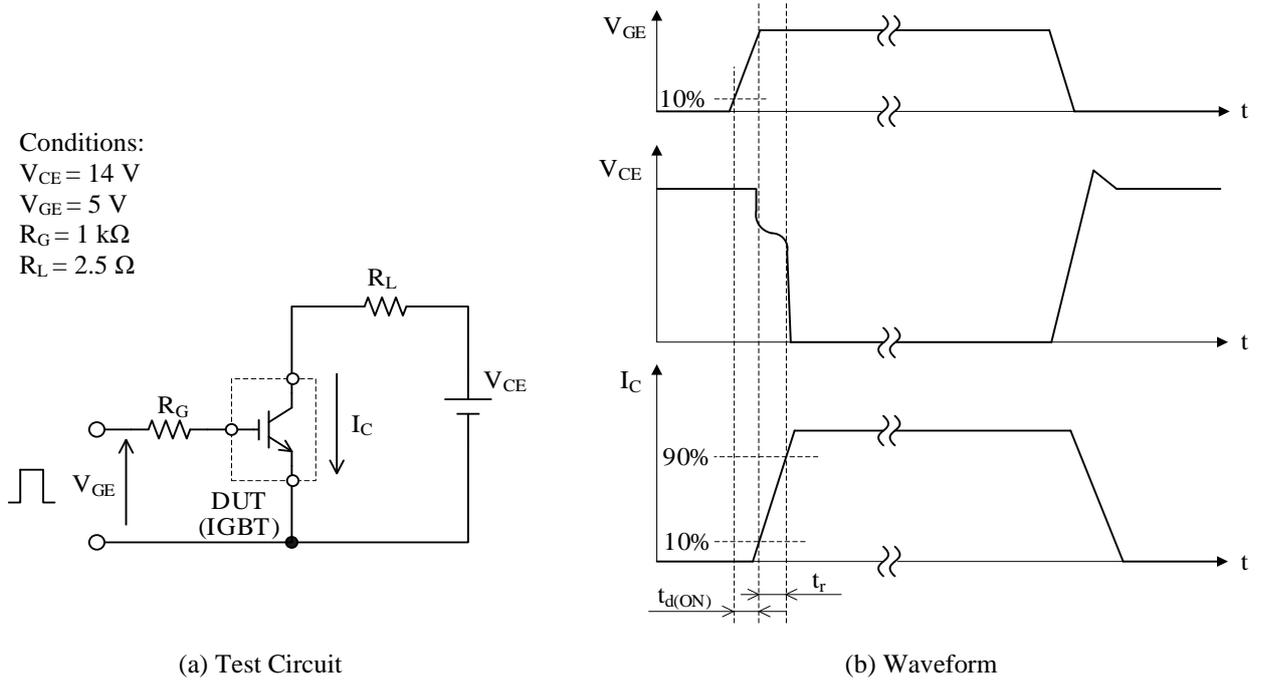


Figure 2. Switching Time Test in Resistive Load

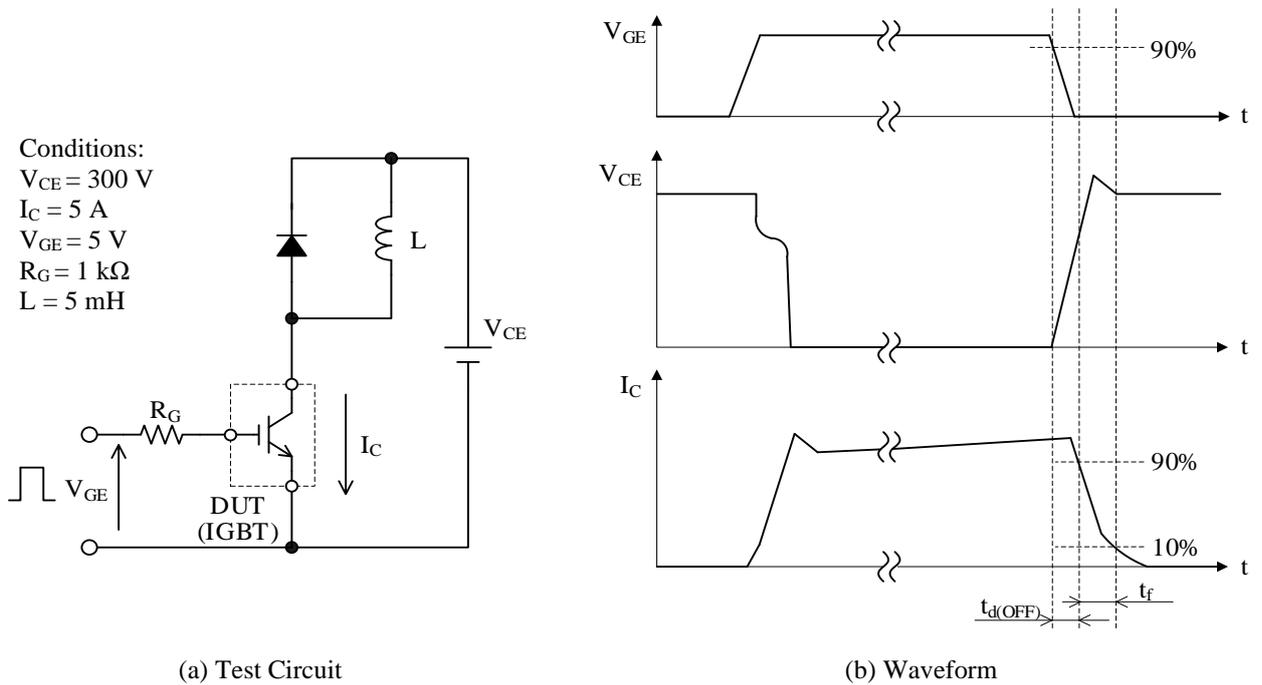


Figure 3. Switching Time Test in Inductive Load

Rating and Typical Characteristic Curves

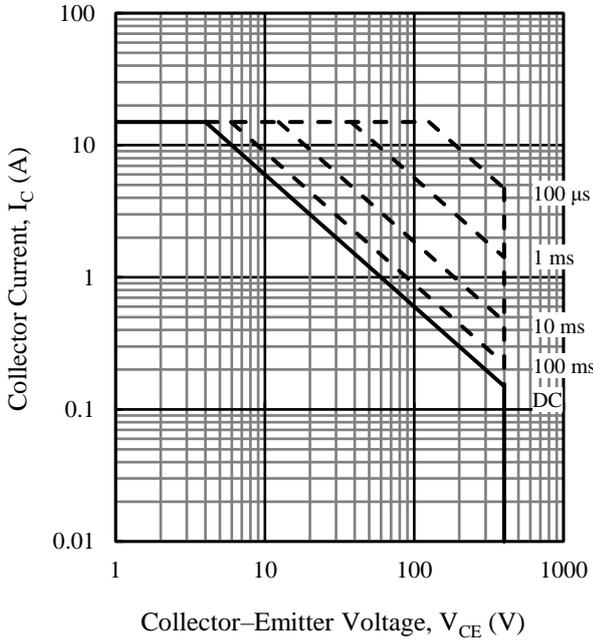


Figure 4. Safe Operating Area

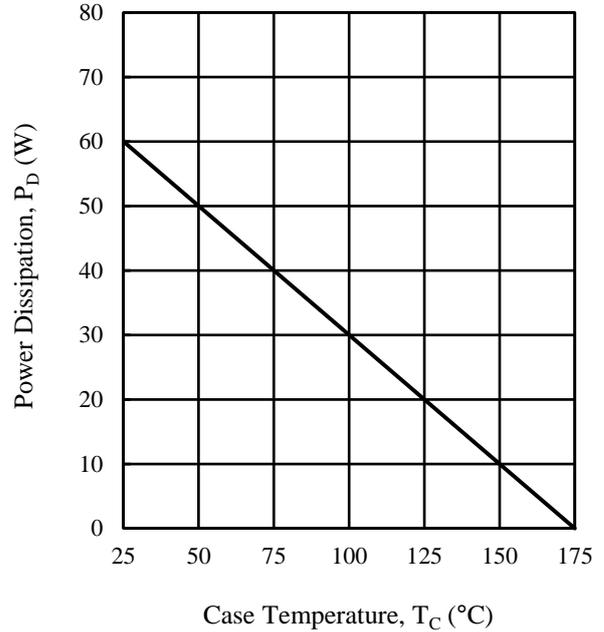


Figure 5. Typical Characteristics: P_D vs. T_C

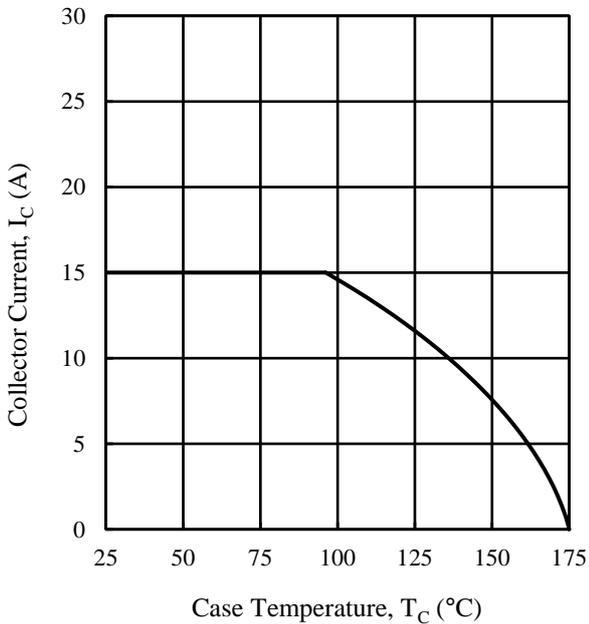


Figure 6. Typical Characteristics: I_C vs. T_C
($V_{GE} = 4.5$ V)

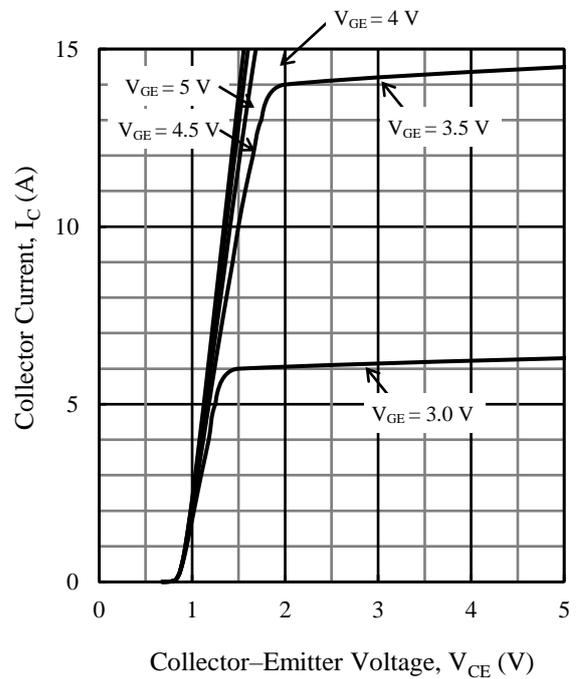


Figure 7. Typical Characteristics: I_C vs. V_{CE}
($T_J = -40$ °C)

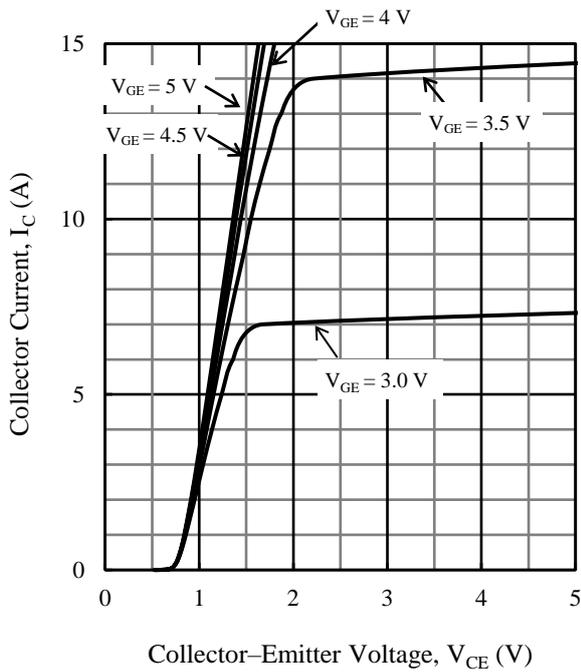


Figure 8. Typical Characteristics: I_C vs. V_{CE}
($T_J = 25\text{ }^\circ\text{C}$)

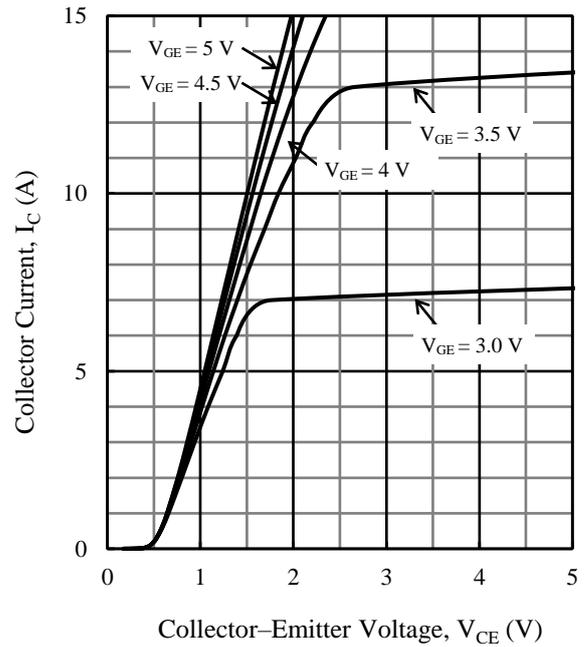


Figure 9. Typical Characteristics: I_C vs. V_{CE}
($T_J = 175\text{ }^\circ\text{C}$)

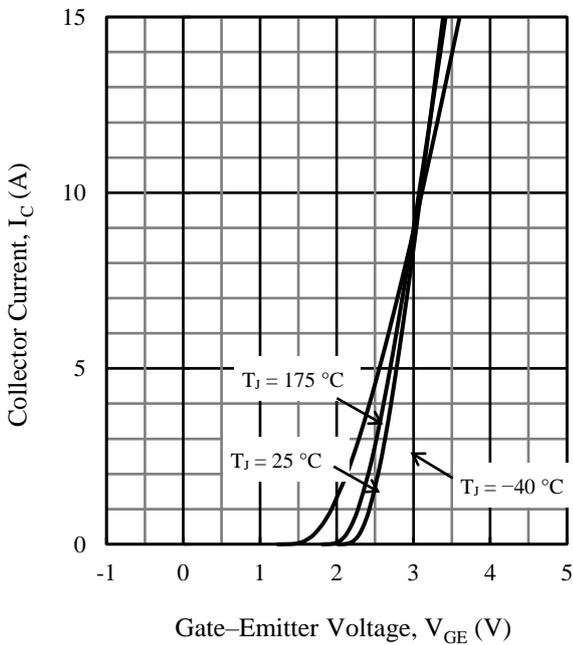


Figure 10. Typical Characteristics: I_C vs. V_{GE}
($V_{CE} = 10\text{ V}$)

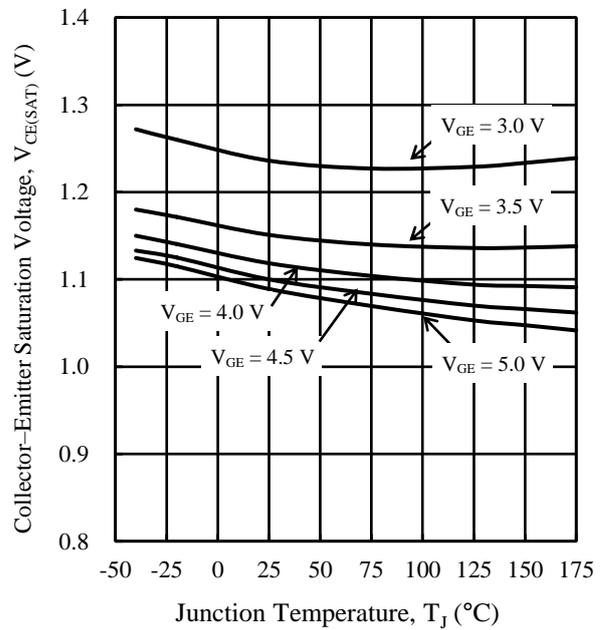


Figure 11. Typical Characteristics: $V_{CE(SAT)}$ vs. T_J
($I_C = 5\text{ A}$)

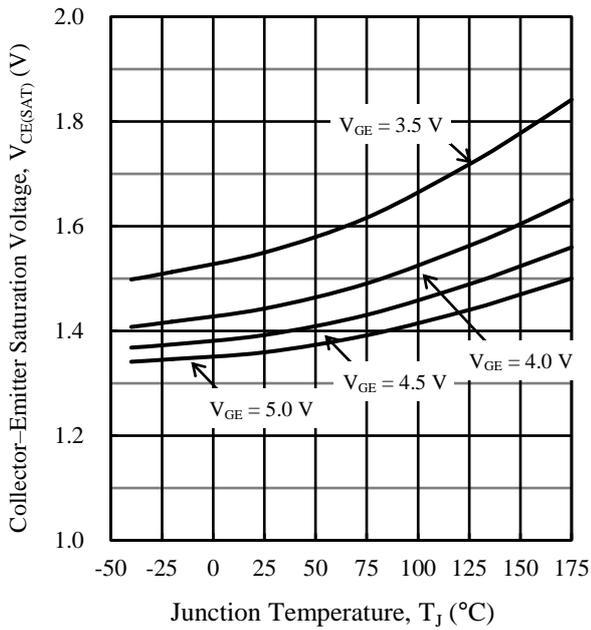


Figure 12. Typical Characteristics: $V_{CE(SAT)}$ vs. T_J ($I_C = 10\text{ A}$)

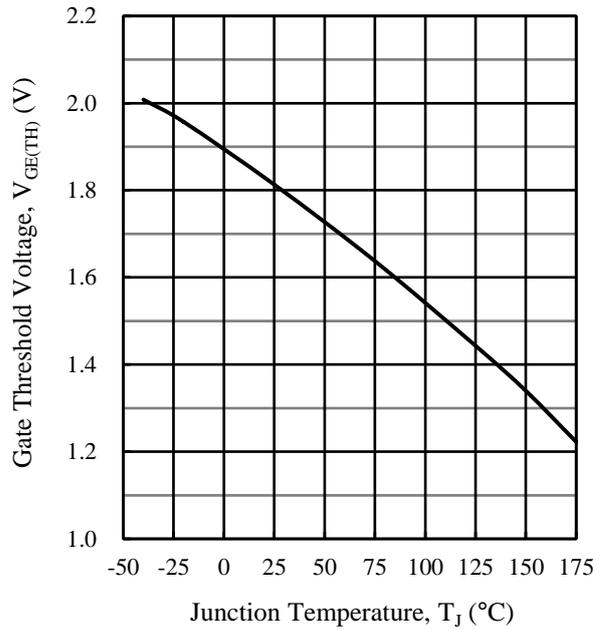


Figure 13. Typical Characteristics: $V_{GE(TH)}$ vs. T_J ($V_{CE} = 10\text{ V}$, $I_C = 1\text{ mA}$)

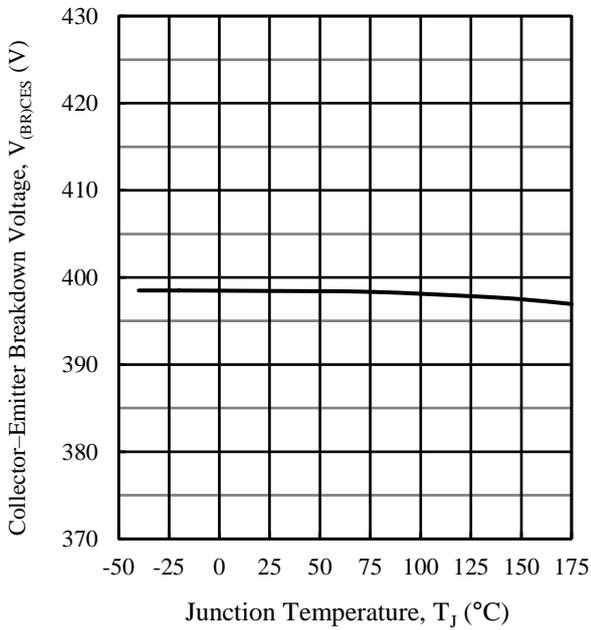


Figure 14. Typical Characteristics: $V_{(BR)CES}$ vs. T_J ($V_{GE} = 0\text{ V}$, $I_C = 2\text{ mA}$)

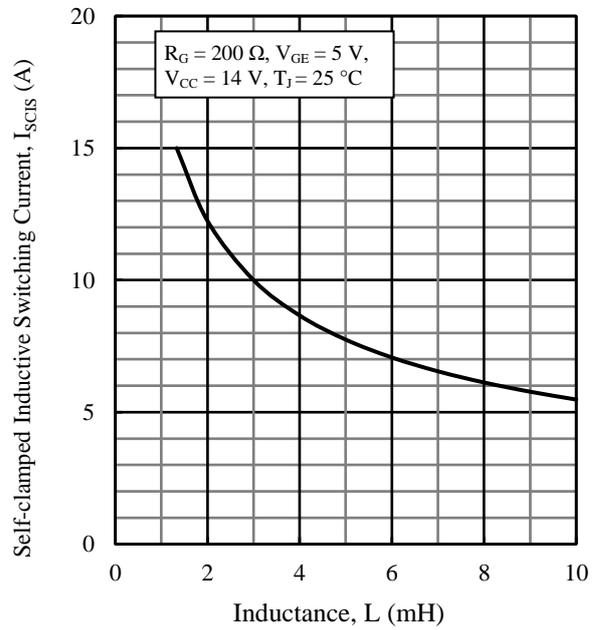


Figure 15. Typical Characteristics: I_{SCIS} vs. L

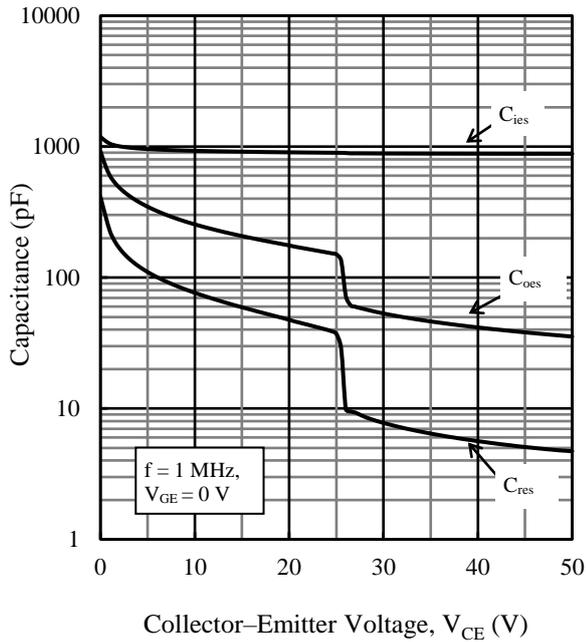


Figure 16. Typical Characteristics: Capacitance vs. V_{CE}

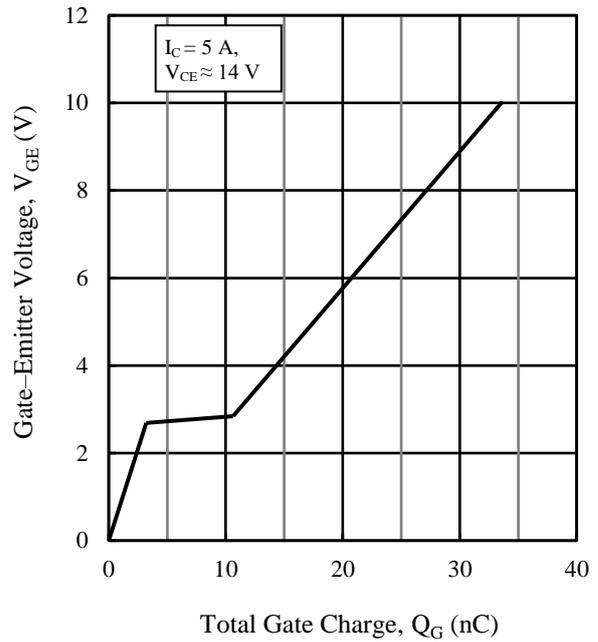


Figure 17. Typical Characteristics: V_{GE} vs. Q_G

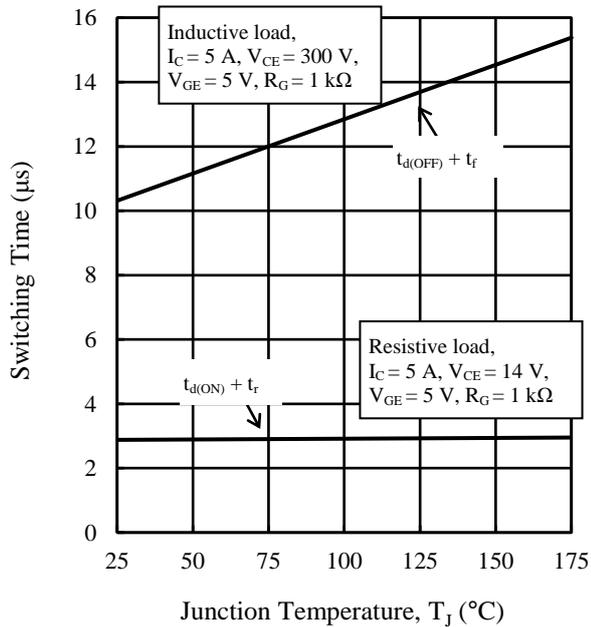


Figure 18. Typical Characteristics: Switching Time vs. T_J

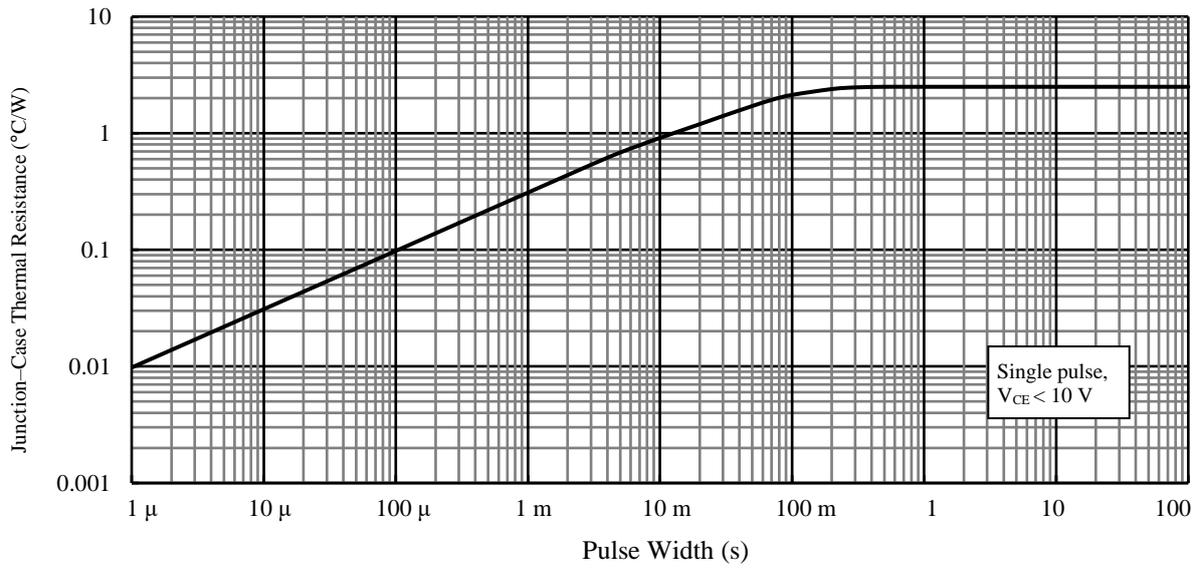
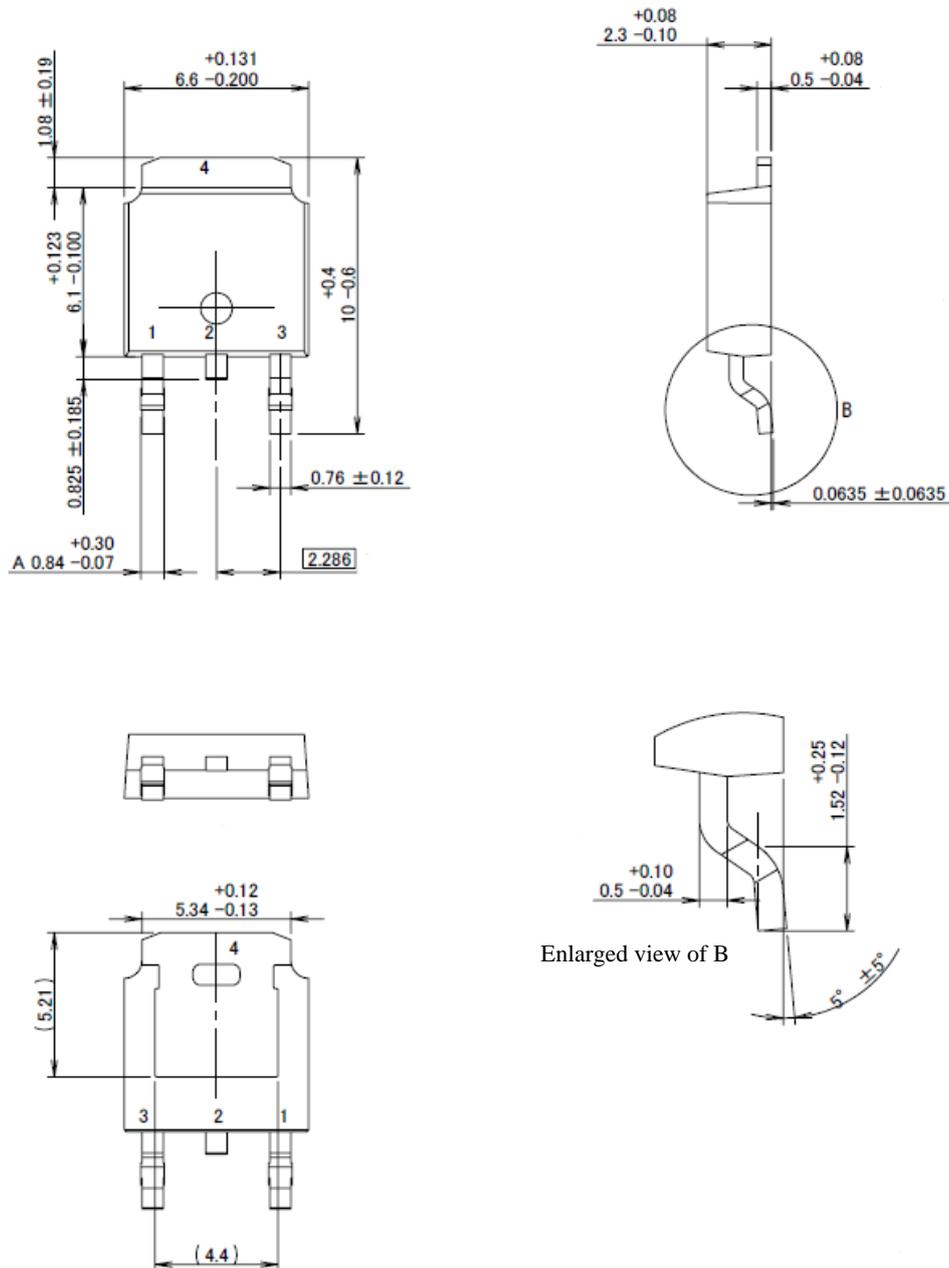


Figure 19. Typical Transient Thermal Resistance Characteristics

DGU4015G

Physical Dimensions

• TO252-2L Package

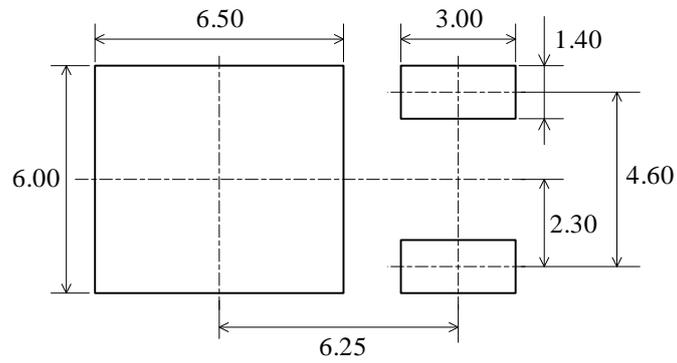


NOTES:

- 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 / 30s, 3 times (260°C peak)
Soldering iron: 350°C / 3.5 s, 1 time

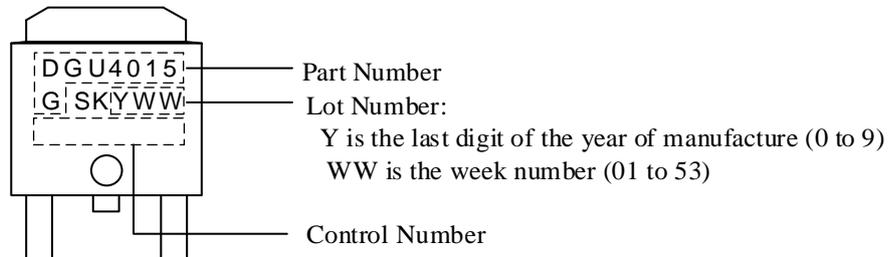
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- TO252-2L Land Pattern Example



Dimensions in millimeters

Marking Diagram



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