

$V_{BR(CES)} = 450\text{ V}$, $I_C = 20\text{ A}$
N-channel Ignition IGBT
DGU4520GR

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

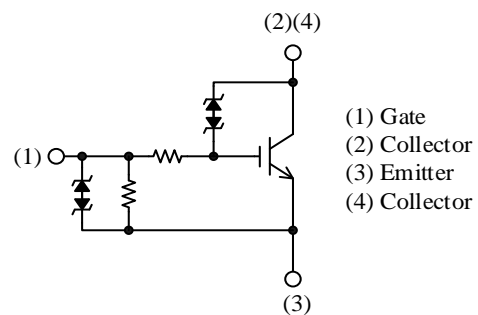
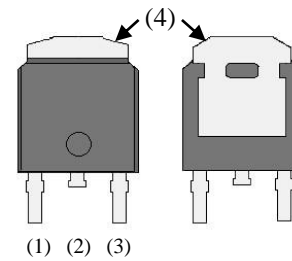
- $V_{(BR)CES}$ ----- 450 V
- I_C ----- 20 A
- $V_{CE(SAT)}$ ----- 1.10 V typ. ($V_{GE} = 4.5\text{ V}$, $I_C = 10\text{ A}$)

Applications

- Ignition Coil Driver Circuits

Packages

TO252-2L



- (1) Gate
- (2) Collector
- (3) Emitter
- (4) Collector

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

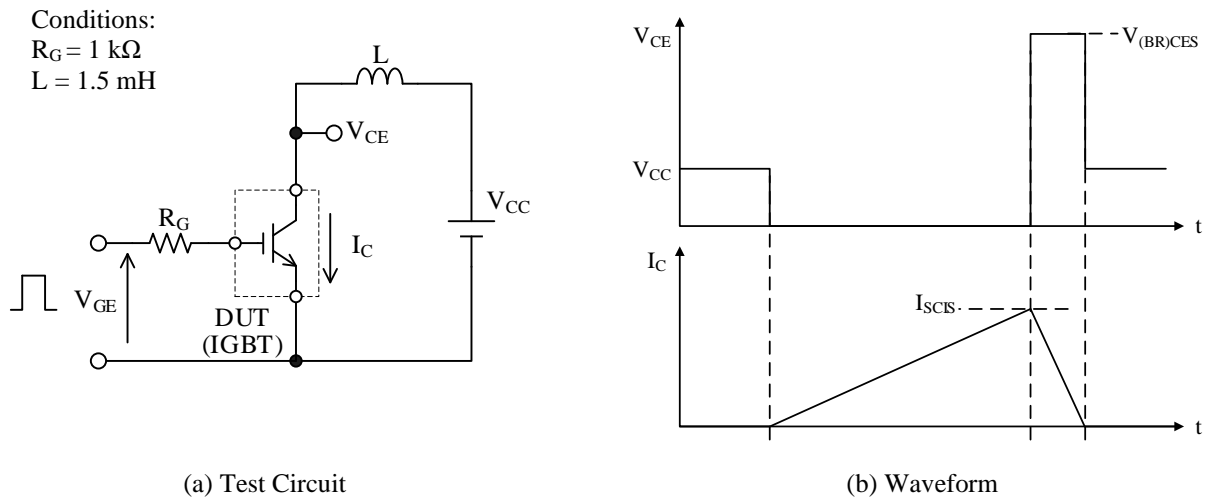


Figure 1. Self-clamped Inductive Switching Energy Test

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

Electrical Characteristics

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
Collector-to-Emitter Breakdown Voltage	$V_{(BR)CES}$	$I_C = 2\text{ mA}$, $V_{GE} = 0\text{ V}$	425	450	475	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	
Collector-to-Emitter Leakage Current	I_{CES}	$V_{CE} = 350\text{ V}$, $V_{GE} = 0\text{ V}$	—	—	100	μA	
Emitter-to-Collector Leakage Current	I_{ECS}	$V_{EC} = 24\text{ V}$	—	—	1.0	mA	
Gate-to-Emitter Leakage Current	I_{GES}	$V_{GE} = \pm 5\text{ V}$	± 89	± 106	± 132	μA	
Gate Threshold Voltage	$V_{GE(TH)}$	$V_{CE} = 10\text{ V}$, $I_C = 1\text{ mA}$	1.40	1.75	2.10	V	
Collector-to-Emitter Saturation Voltage	$V_{CE(SAT)}$	$T_J = 25\text{ }^\circ\text{C}$	$V_{GE} = 3.5\text{ V}$, $I_C = 10\text{ A}$	—	1.16	1.39	V
			$V_{GE} = 4.5\text{ V}$, $I_C = 10\text{ A}$	—	1.10	1.32	V
			$V_{GE} = 4.5\text{ V}$, $I_C = 15\text{ A}$	—	1.25	1.50	V
			$V_{GE} = 4.5\text{ V}$, $I_C = 20\text{ A}$	—	1.39	1.67	V
		$T_J = 150\text{ }^\circ\text{C}$	$V_{GE} = 3.5\text{ V}$, $I_C = 10\text{ A}$	—	1.15	1.50	V
			$V_{GE} = 4.5\text{ V}$, $I_C = 10\text{ A}$	—	1.08	1.40	V
			$V_{GE} = 4.5\text{ V}$, $I_C = 15\text{ A}$	—	1.31	1.77	V
			$V_{GE} = 4.5\text{ V}$, $I_C = 20\text{ A}$	—	1.58	2.13	V
Input Capacitance	C_{ies}	$V_{CE} = 10\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1.0\text{ MHz}$	—	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⁾	$R_{GE(INT)}$	$T_J = -40\text{ to }175\text{ }^\circ\text{C}$	37.6	47.0	61.1 ⁽²⁾	k Ω	

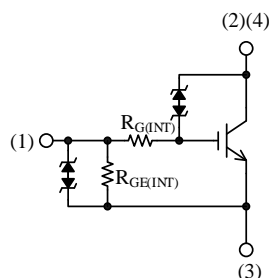


Figure 2. Internal Gate Resistor

⁽¹⁾ See Figure 2
⁽²⁾ Guaranteed by design.

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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

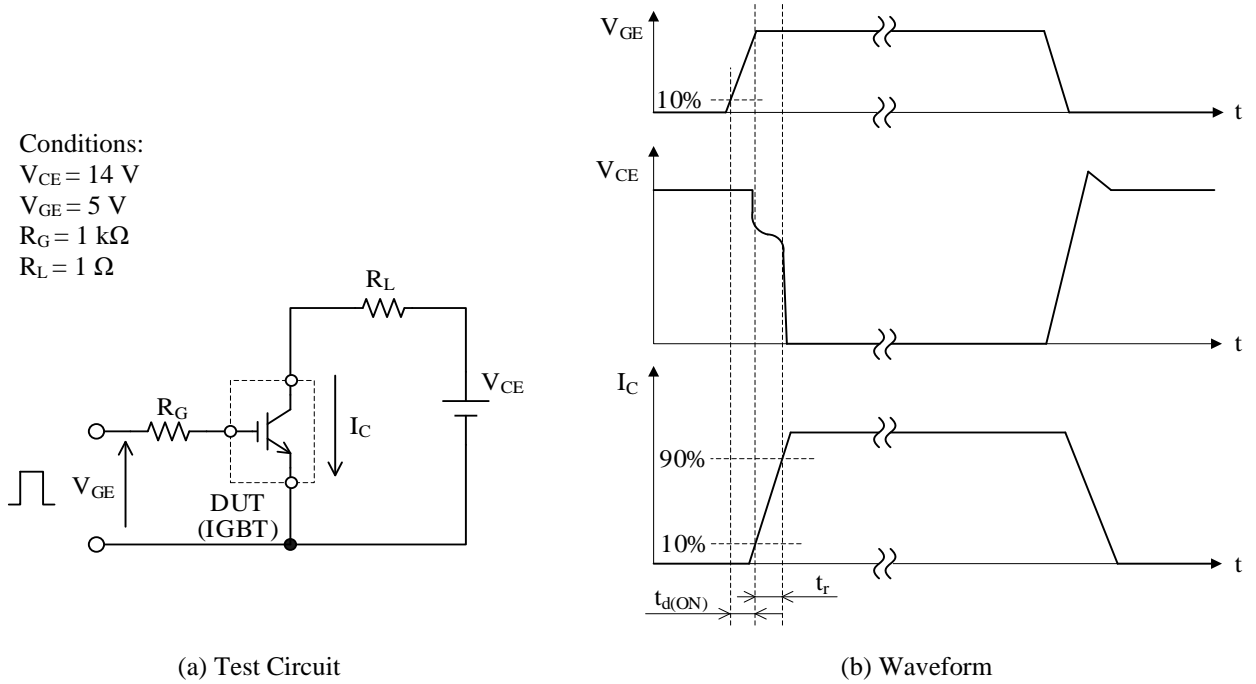


Figure 3. Switching Time Test in Resistive Load

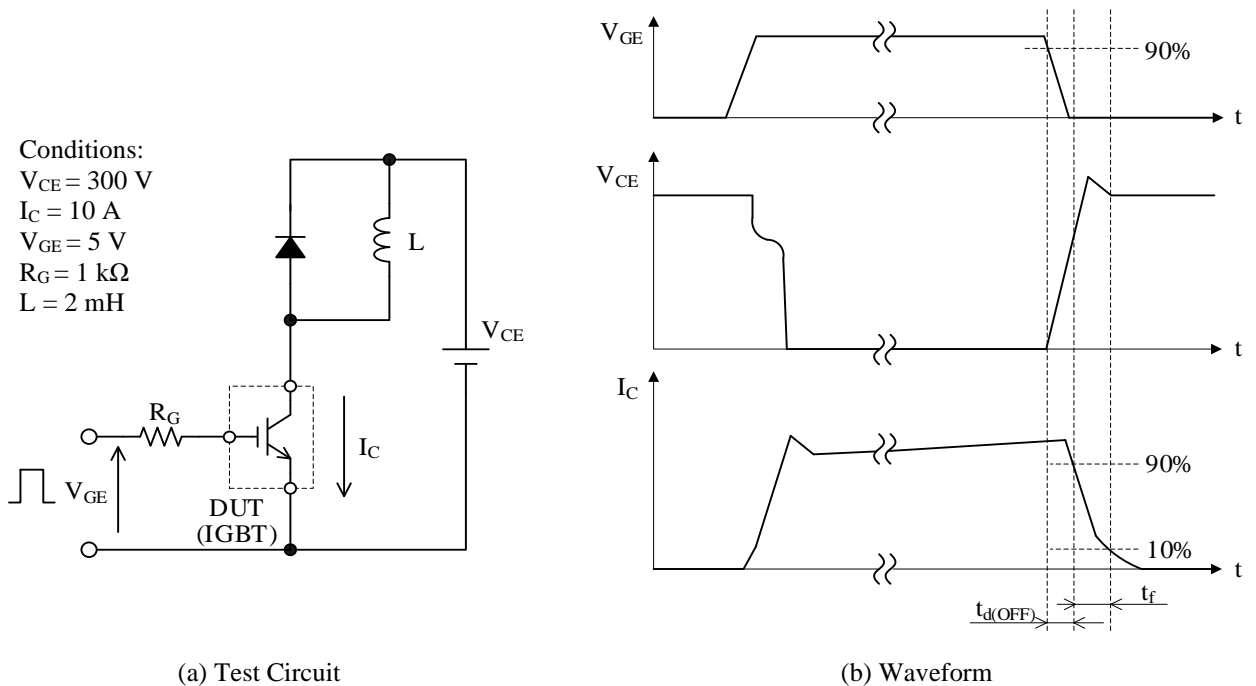


Figure 4. Switching Time Test in Inductive Load

Rating and Typical Characteristic Curves

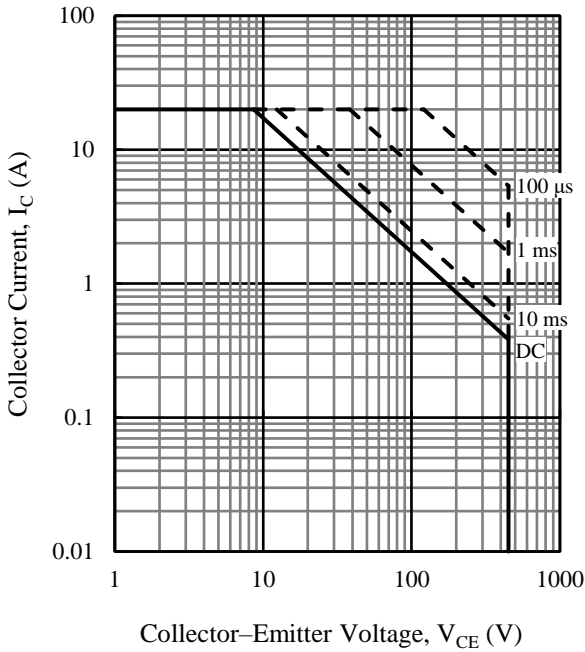


Figure 5. Safe Operating Area

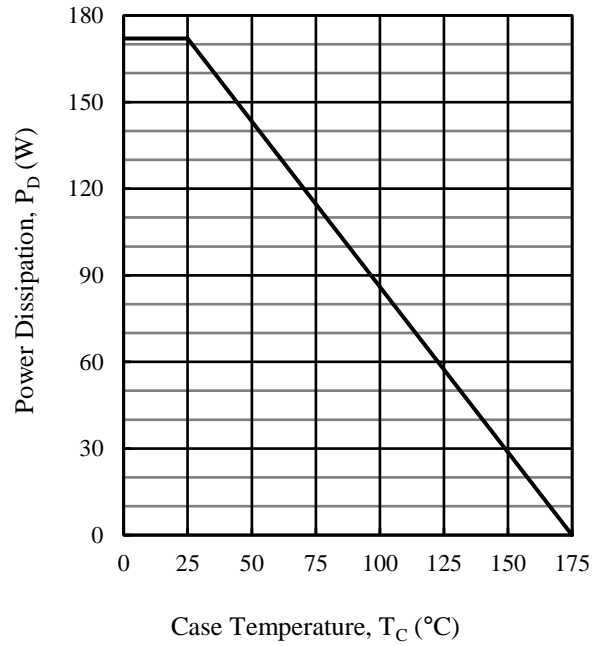


Figure 6. Typical Characteristics: P_D vs. T_C

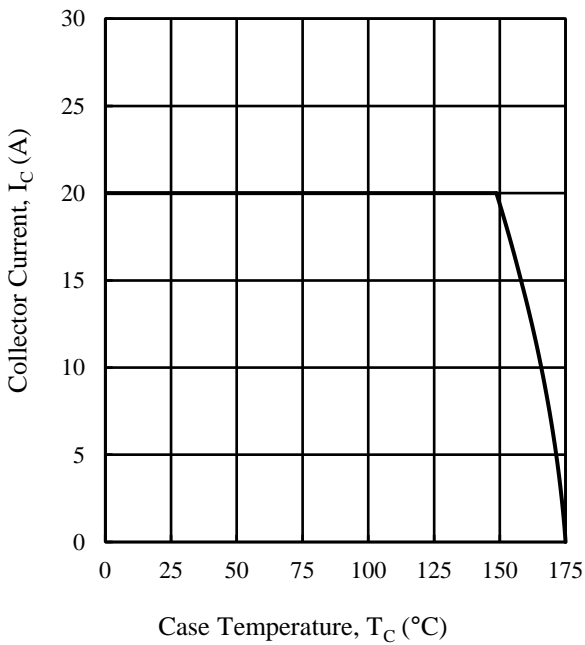


Figure 7. Typical Characteristics: I_C vs. T_C
($V_{GE} = 5$ V)

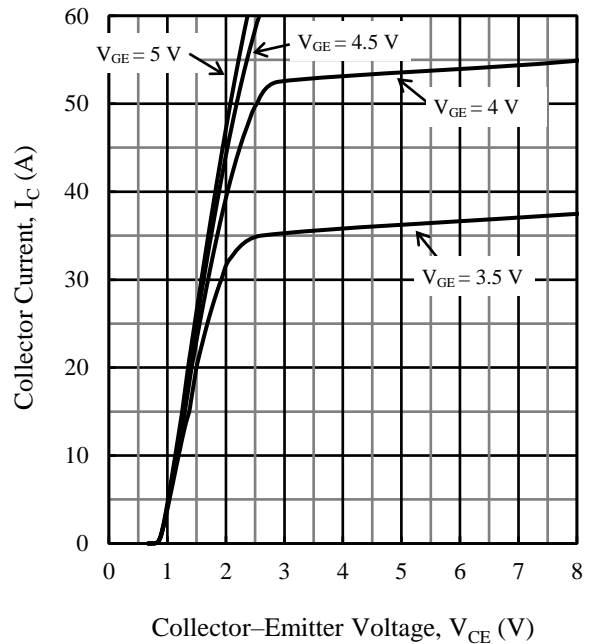


Figure 8. Typical Characteristics: I_C vs. V_{CE}
($T_J = -40$ °C)

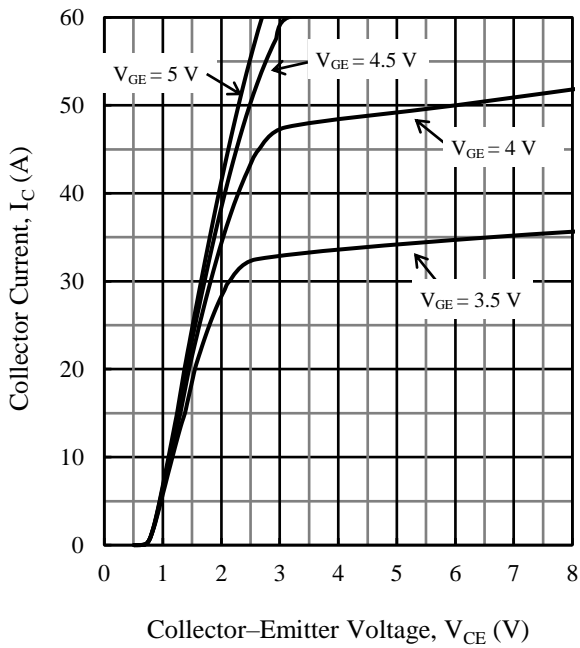


Figure 9. Typical Characteristics: I_C vs. V_{CE} ($T_J = 25\text{ }^\circ\text{C}$)

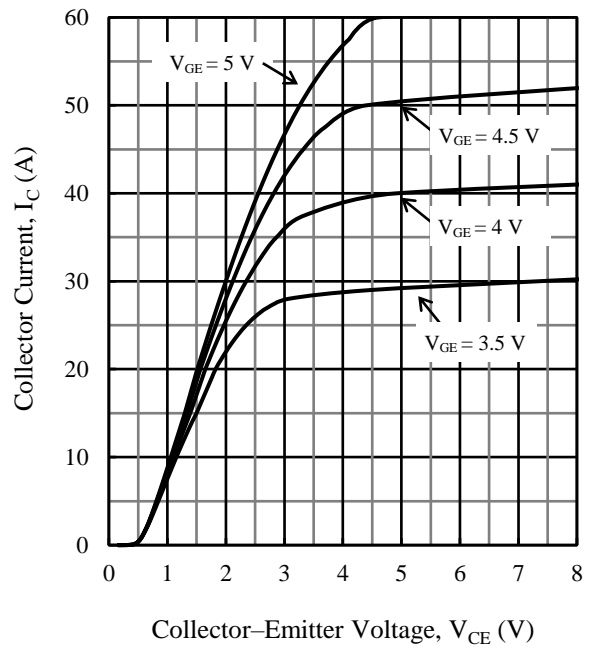


Figure 10. Typical Characteristics: I_C vs. V_{CE} ($T_J = 175\text{ }^\circ\text{C}$)

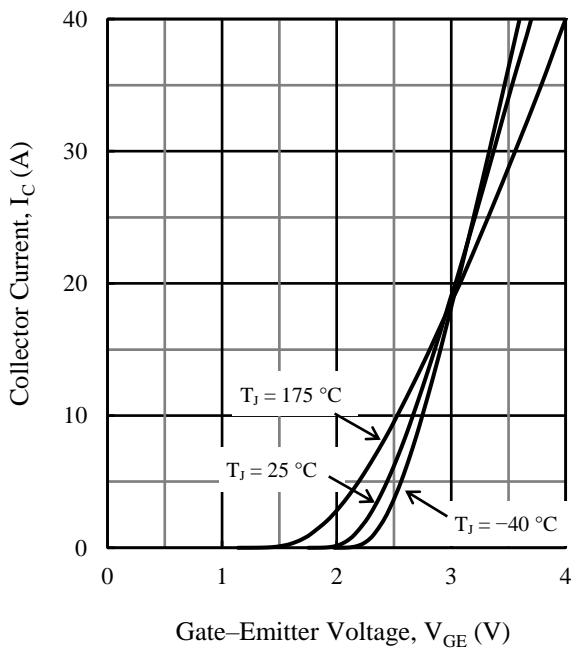


Figure 11. Typical Characteristics: I_C vs. V_{GE} ($V_{CE} = 5\text{ V}$)

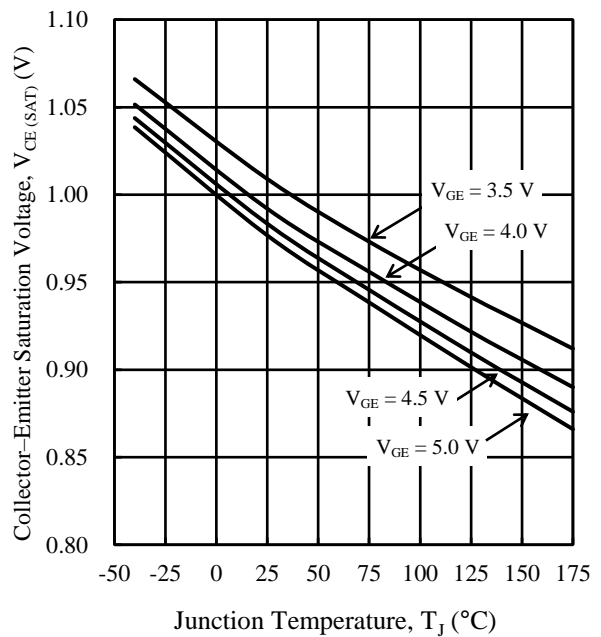


Figure 12. Typical Characteristics: $V_{CE(SAT)}$ vs. T_J ($I_C = 6\text{ A}$)

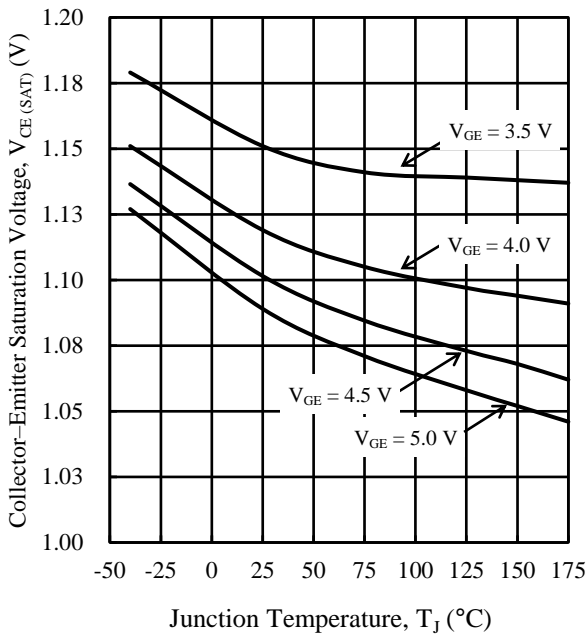


Figure 13. Typical Characteristics: $V_{CE(SAT)}$ vs. T_J ($I_C = 10\text{ A}$)

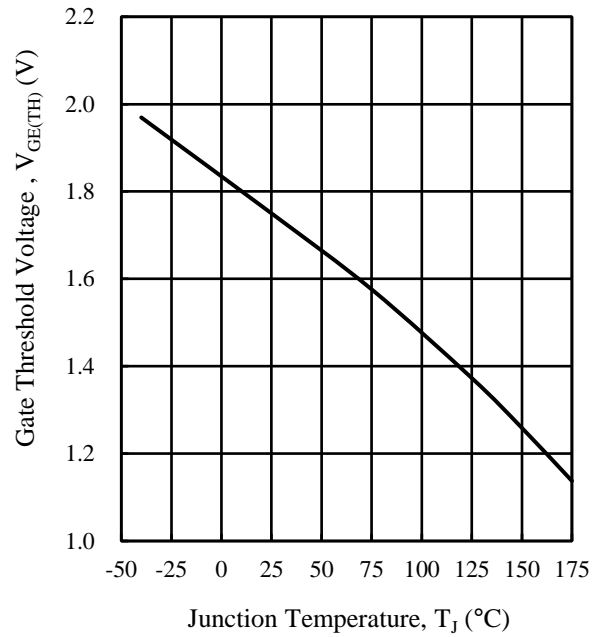


Figure 14. Typical Characteristics: $V_{GE(TH)}$ vs. T_J ($V_{CE} = 10\text{ V}$, $I_C = 1\text{ mA}$)

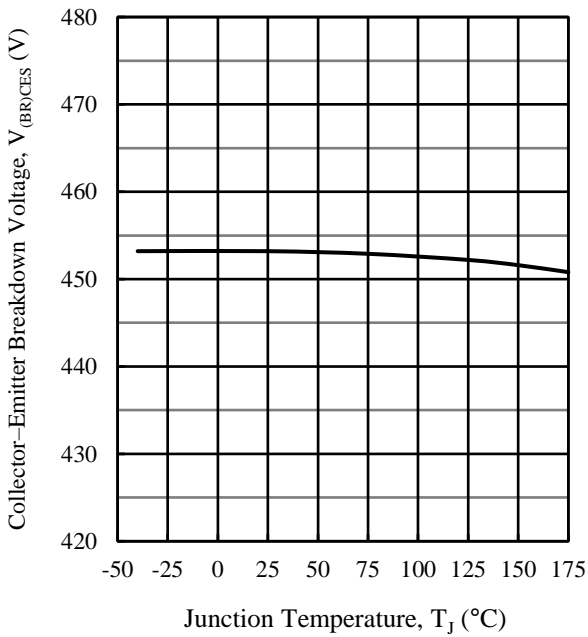


Figure 15. Typical Characteristics: $V_{(BR)CES}$ vs. T_J ($V_{GE} = 0\text{ V}$, $I_C = 2\text{ mA}$)

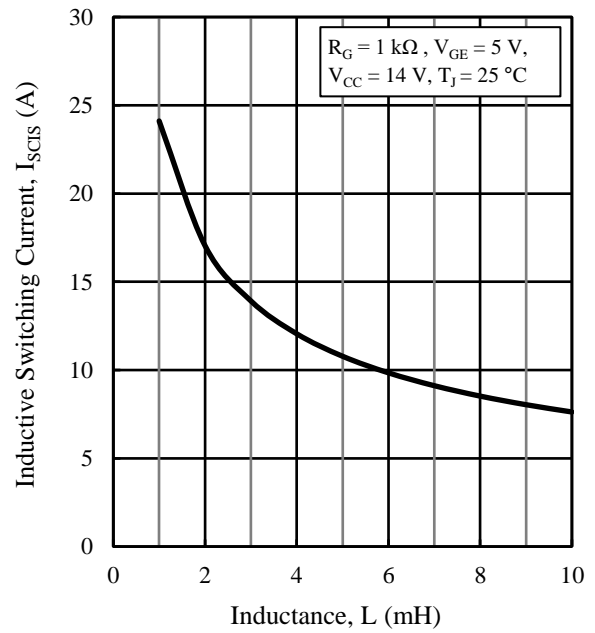


Figure 16. Typical Characteristics: I_{SCIS} vs. L

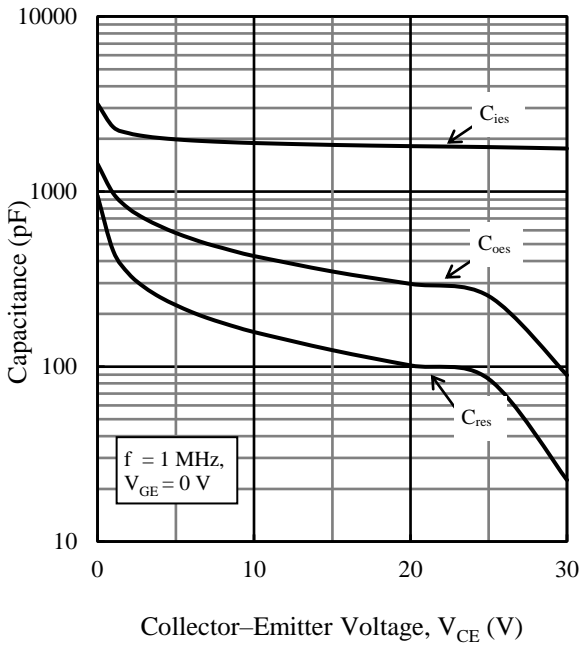


Figure 17. Typical Characteristics:
Capacitance vs. V_{CE}

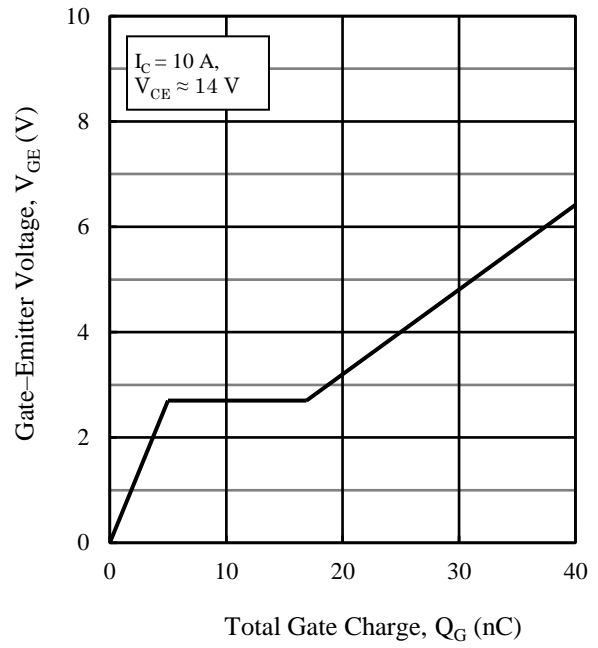


Figure 18. Typical Characteristics: V_{GE} vs. Q_G

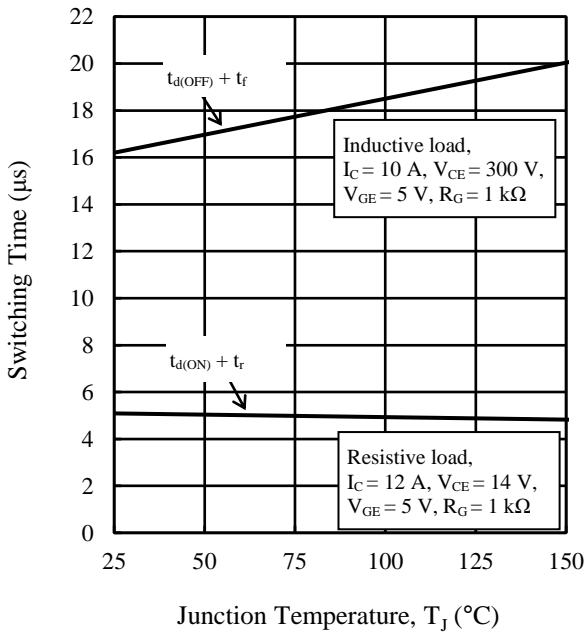


Figure 19. Typical Characteristics:
Switching Time vs. T_J

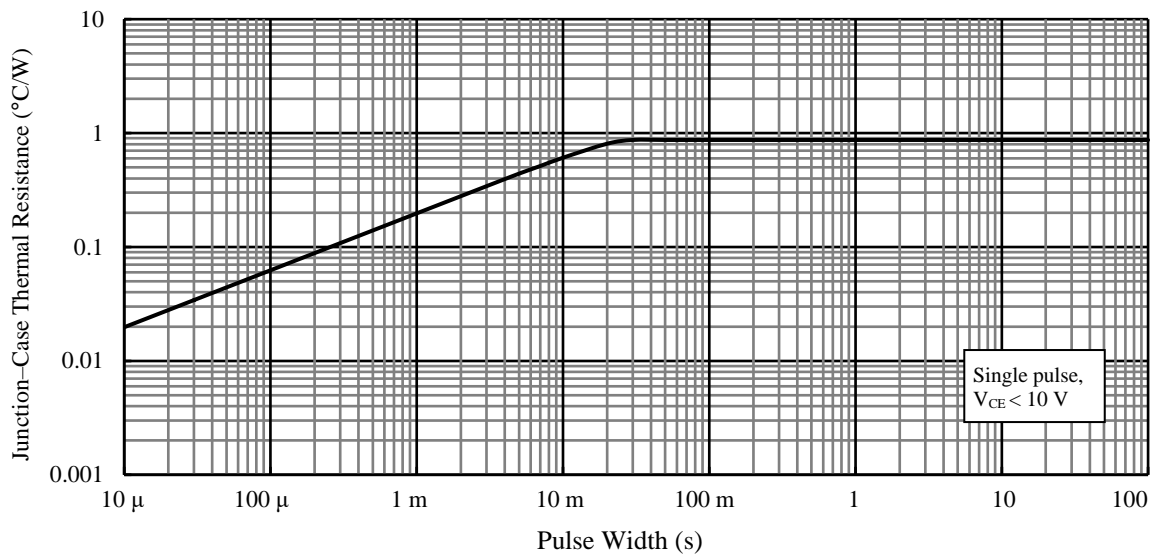
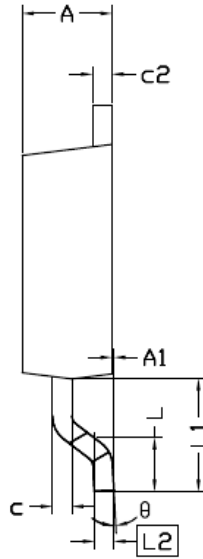
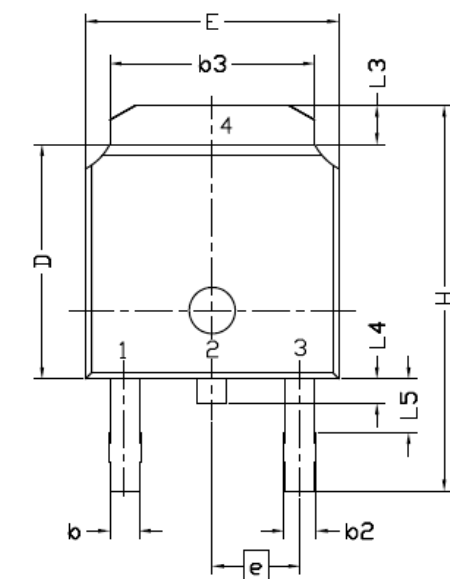


Figure 20. Typical Transient Thermal Resistance Characteristics

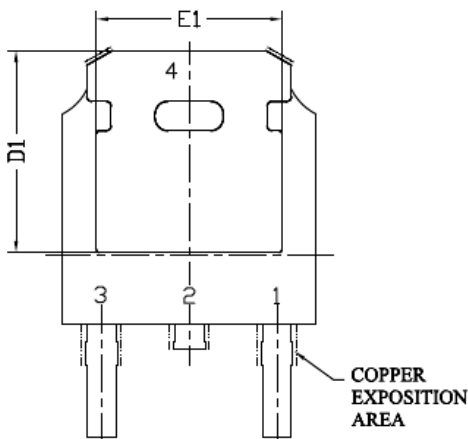
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Physical Dimensions

● TO252-2L Package



SYMBOL	DIMENSIONAL REQMTS		
	MIN	NDM	MAX
E	6.40	6.60	6.731
L	1.40	1.52	1.77
L1	2.743 REF		
L2	0.508 BSC		
L3	0.89	--	1.27
L4	0.64	--	1.01
L5	--	--	--
D	6.00	6.10	6.223
H	9.40	10.00	10.40
b	0.64	0.76	0.88
b2	0.77	0.84	1.14
b3	5.21	5.34	5.46
e	2.286 BSC		
A	2.20	2.30	2.38
A1	0	--	0.127
c	0.46	0.50	0.60
c2	0.46	0.50	0.58
D1	5.21	--	--
E1	4.40	--	--
θ	0°	--	10°

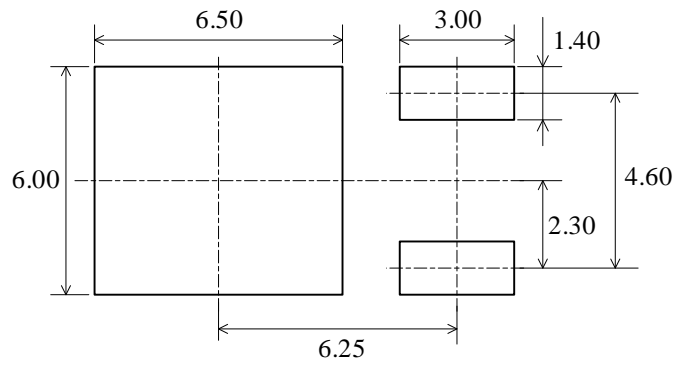


NOTES:

- Dimensions in millimeters
- All the dimensions exclude mold flashes.
- 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

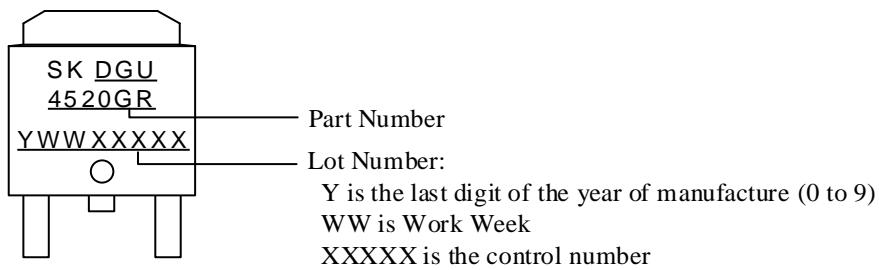
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• TO252-2L Land Pattern Example



Dimensions in millimeters

Marking Diagram



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