

$V_{BR(CES)} = 450\text{ V}$, $I_C = 20\text{ A}$
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

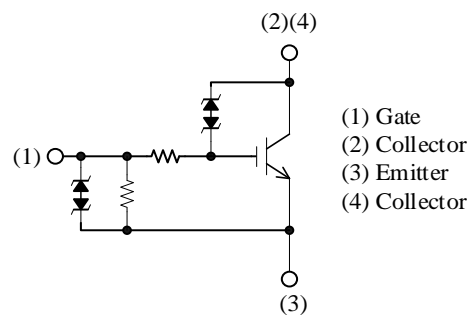
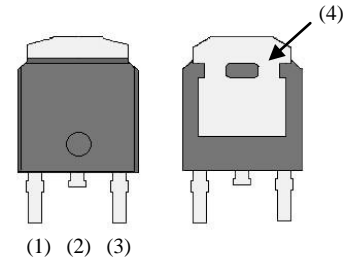
- Suitable for High Reliability Applications
 - Complies with Automotive Quality Requirements
 - Bare Lead Frame: Pb-free (RoHS Compliant)
 - Built-in Zener Diodes
 - Built-in Gate Resistors
 - Low Saturation Voltage
-
- $V_{(BR)CES}$ ----- 450 V
 - I_C ----- 20 A
 - $V_{CE(sat)}$ ----- 1.10 V typ. ($V_{GE} = 4.5\text{ V}$, $I_C = 10\text{ A}$)

Applications

- Ignition Coil Driver Circuits

Packages

TO252



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	$^\circ\text{C}$

Thermal Characteristics

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

Electrical Characteristics

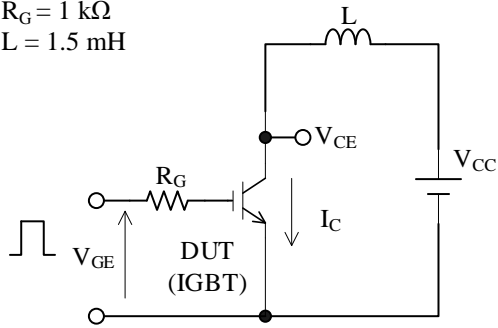
Unless otherwise specified, $T_A = 25\text{ }^\circ\text{C}$.

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	$V_{(BR)GES}$	$I_G = \pm 1\text{ mA}$, $V_{GE} = 0\text{ V}$	± 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	
Reverse Collector to Emitter 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 (Resistive)	$t_{d(on)R}$	Resistive load, see Figure 2	—	1.3	—	μs	
Rise Time (Resistive)	t_{rR}		—	3.8	—	μs	
Turn-off Delay Time (Inductive)	$t_{d(off)L}$	Inductive load, see Figure 3	—	13.5	—	μs	
Fall Time (Inductive)	t_{fL}		—	2.7	—	μs	
Series Gate Resistor	R_G		—	70	—	Ω	
Gate to Emitter Resistor	R_{GE}	$T_J = -40\text{ to }175\text{ }^\circ\text{C}$	37.6	47.0	$61.1^{(1)}$	k Ω	

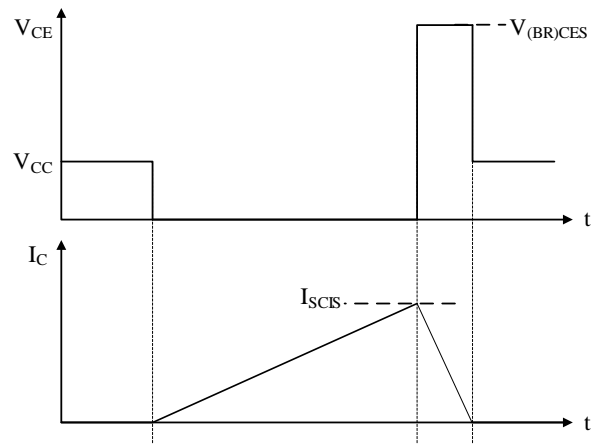
⁽¹⁾ Guaranteed by design.

Test Circuits and Waveforms

Conditions:
 $R_G = 1 \text{ k}\Omega$
 $L = 1.5 \text{ mH}$



(a) Test Circuit



(b) Waveform

Figure 1. E_{SCIS} Test Circuits and Switching Time Waveforms

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

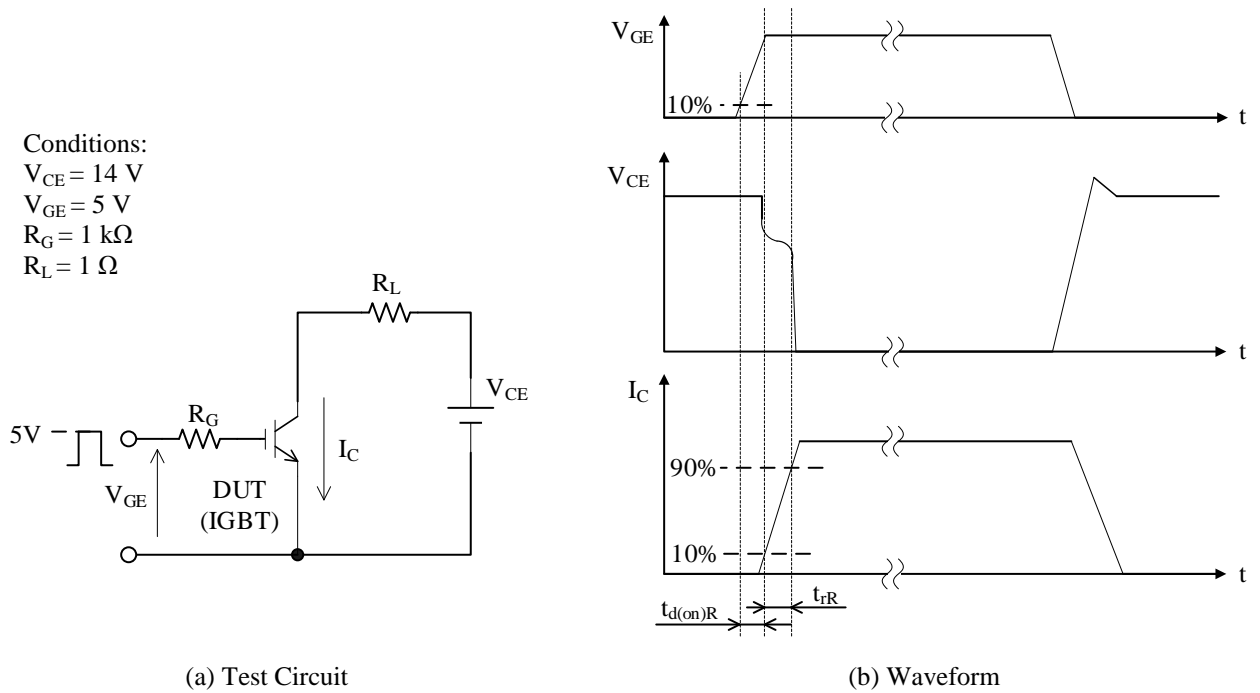


Figure 2. Resistive Load Test Circuits and Switching Time Waveforms

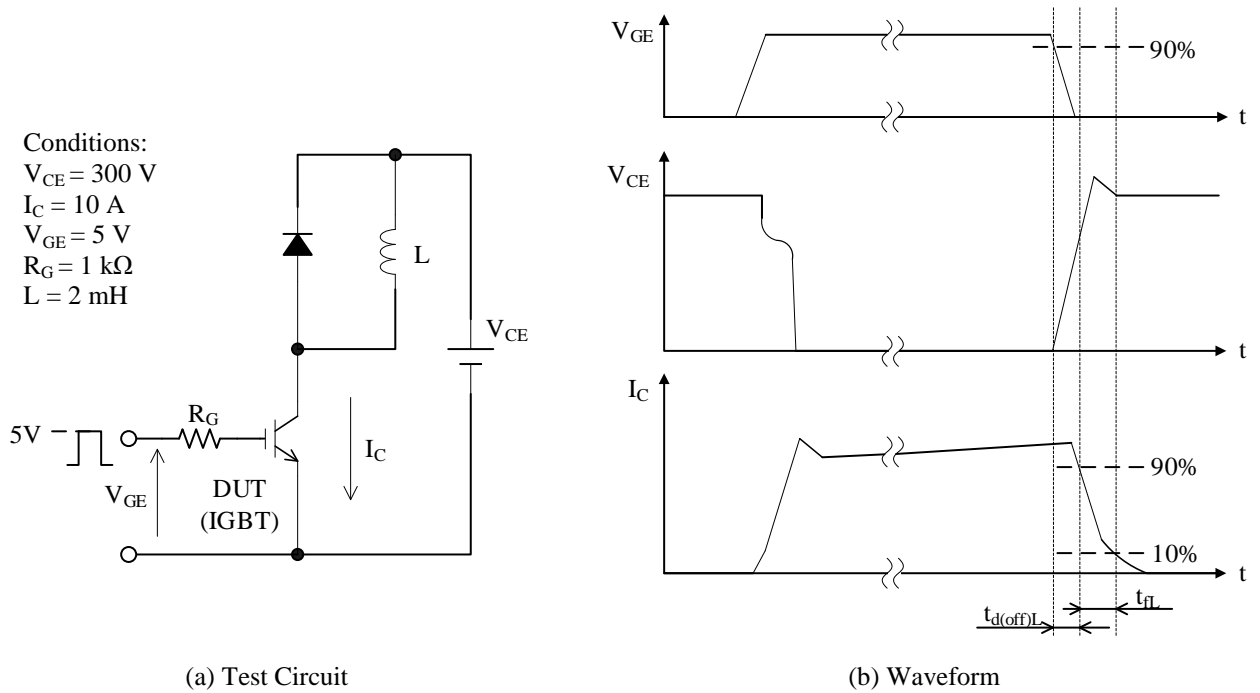


Figure 3. Inductive Load Test Circuits and Switching Time Waveforms

Rating and Characteristic Curves

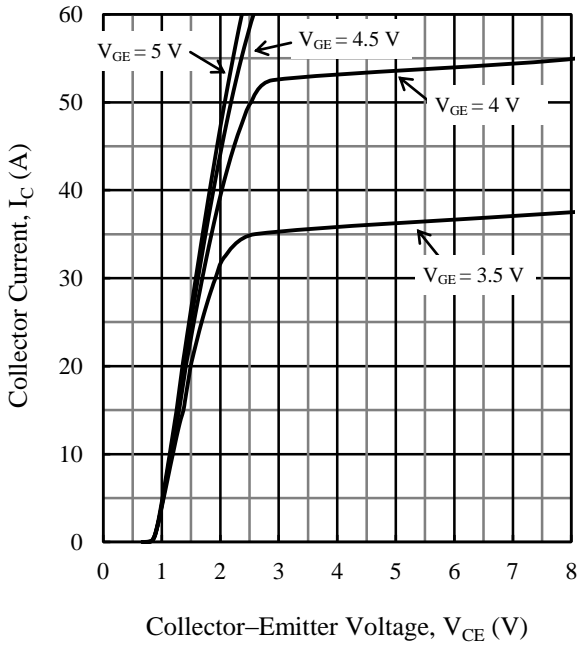


Figure 4. Output Characteristics ($T_J = -40\text{ }^\circ\text{C}$)

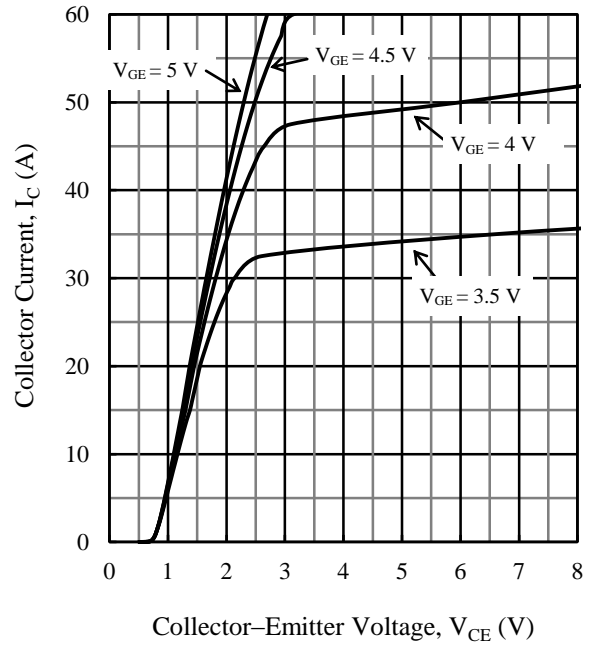


Figure 5. Output Characteristics ($T_J = 25\text{ }^\circ\text{C}$)

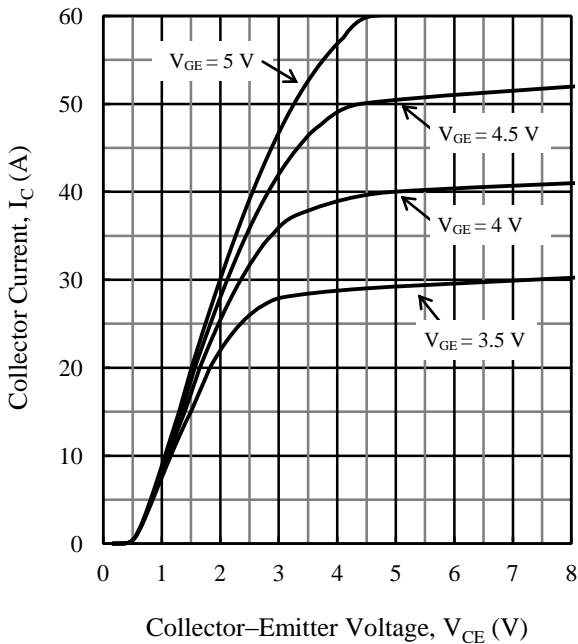


Figure 6. Output Characteristics ($T_J = 175\text{ }^\circ\text{C}$)

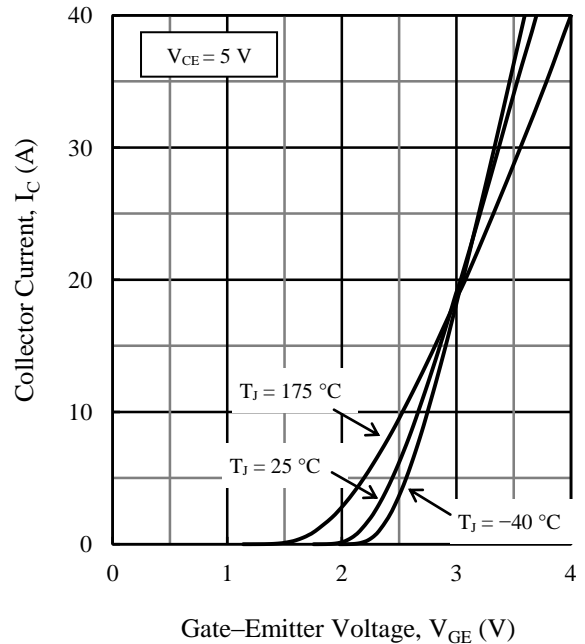


Figure 7. Transfer Characteristics

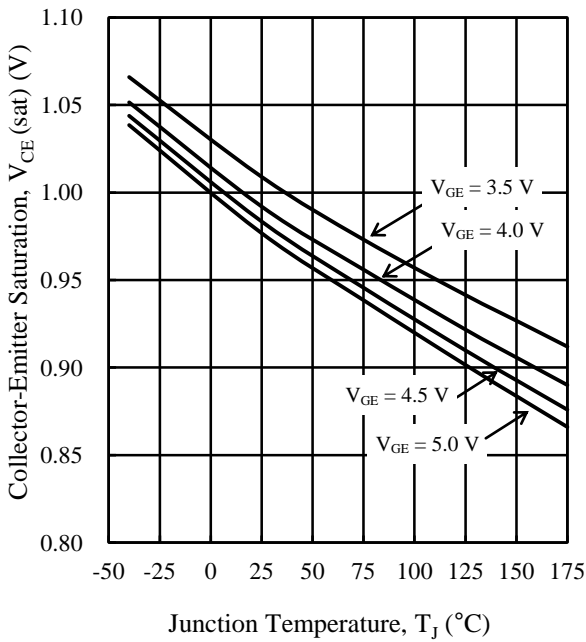


Figure 8. Saturation Voltage vs. Junction Temperature ($I_C = 6\text{ A}$)

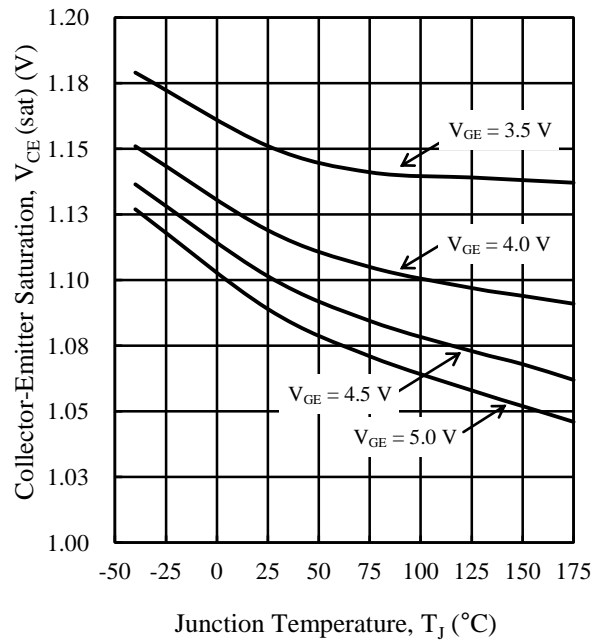


Figure 9. Saturation Voltage vs. Junction Temperature ($I_C = 10\text{ A}$)

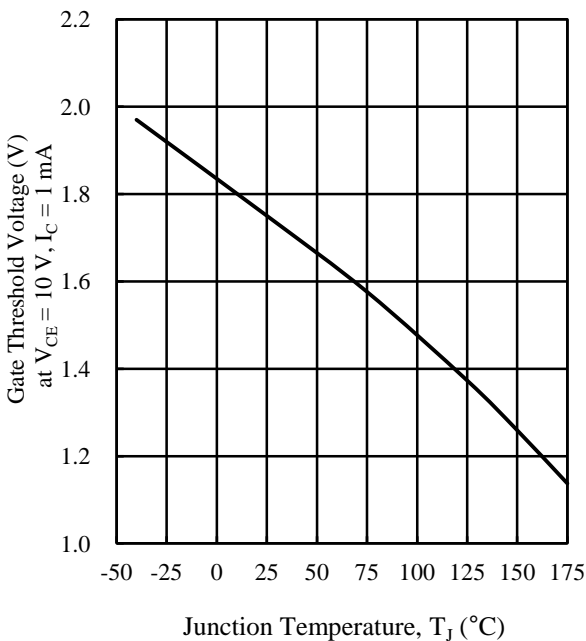


Figure 10. Gate Threshold Voltage vs. Junction Temperature

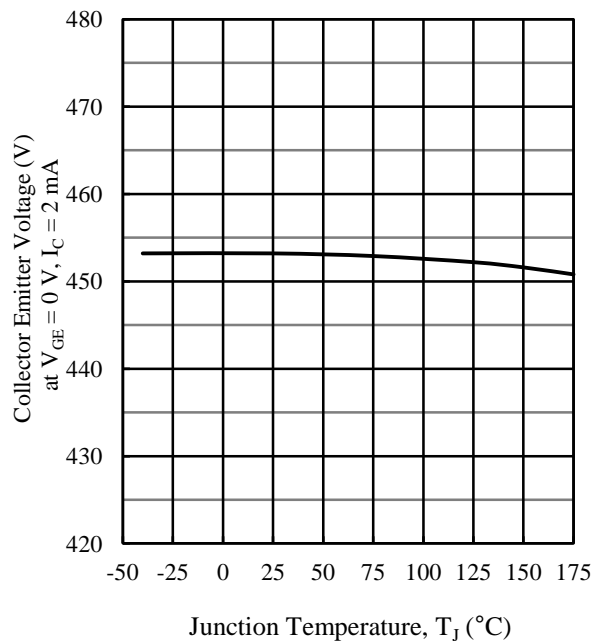


Figure 11. Collector-Emitter Voltage vs. Junction Temperature

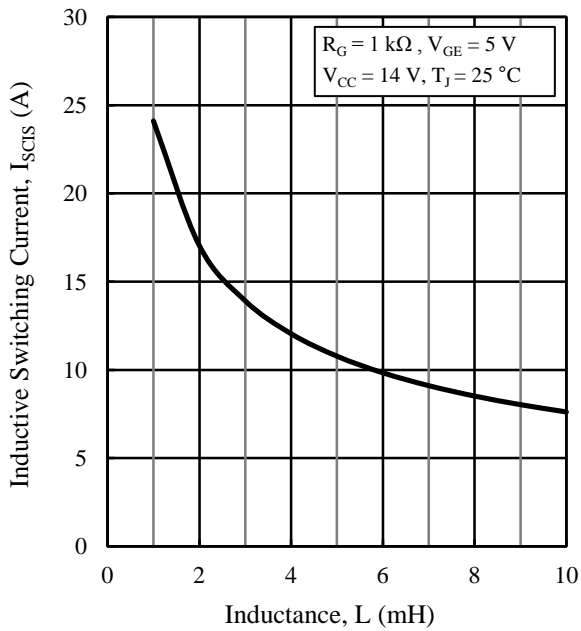


Figure 12. Inductive Switching Current vs. Inductance

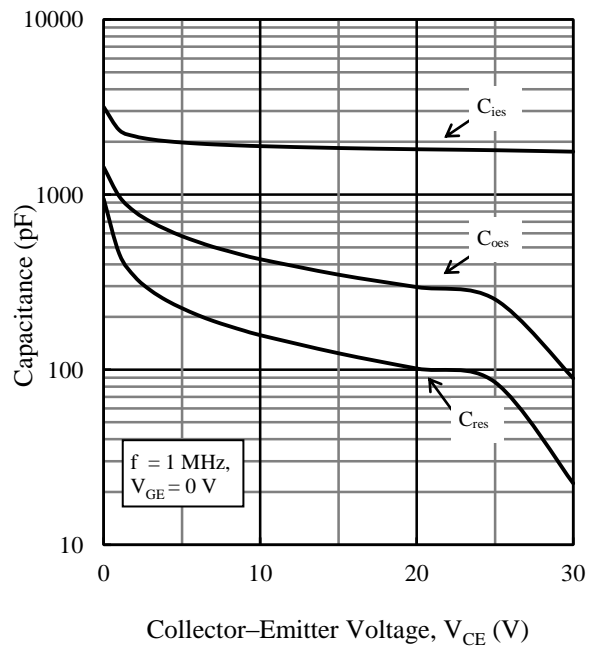


Figure 13. Capacitance Characteristics

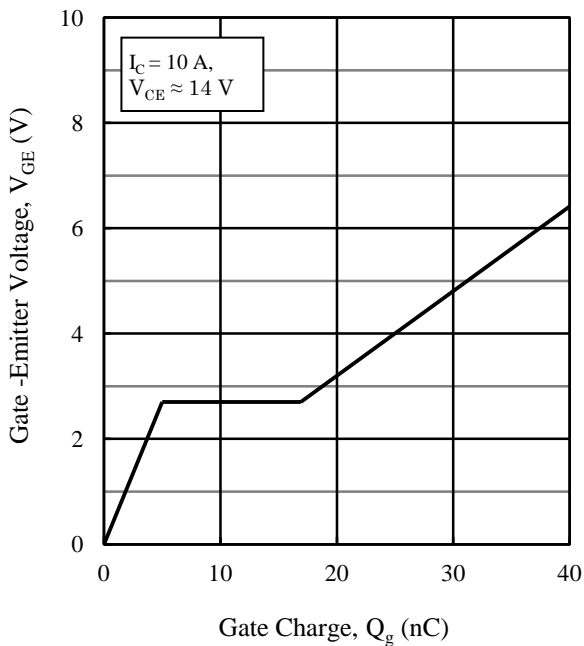


Figure 14. Typical Gate Charge

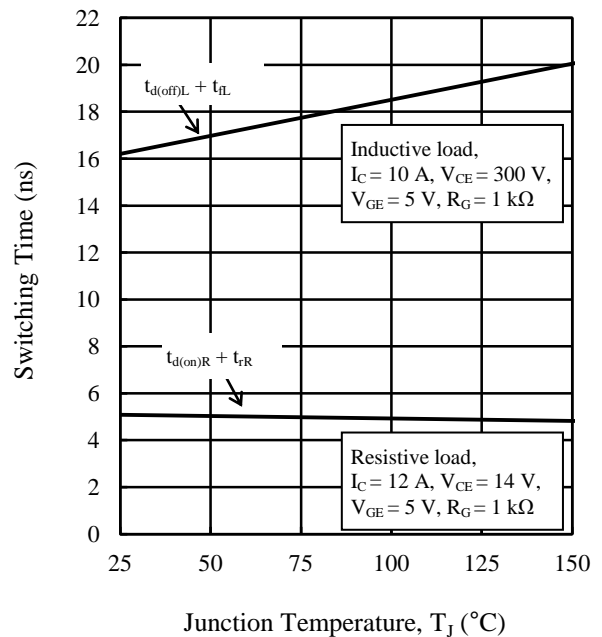


Figure 15. Switching Time vs. Junction Temperature

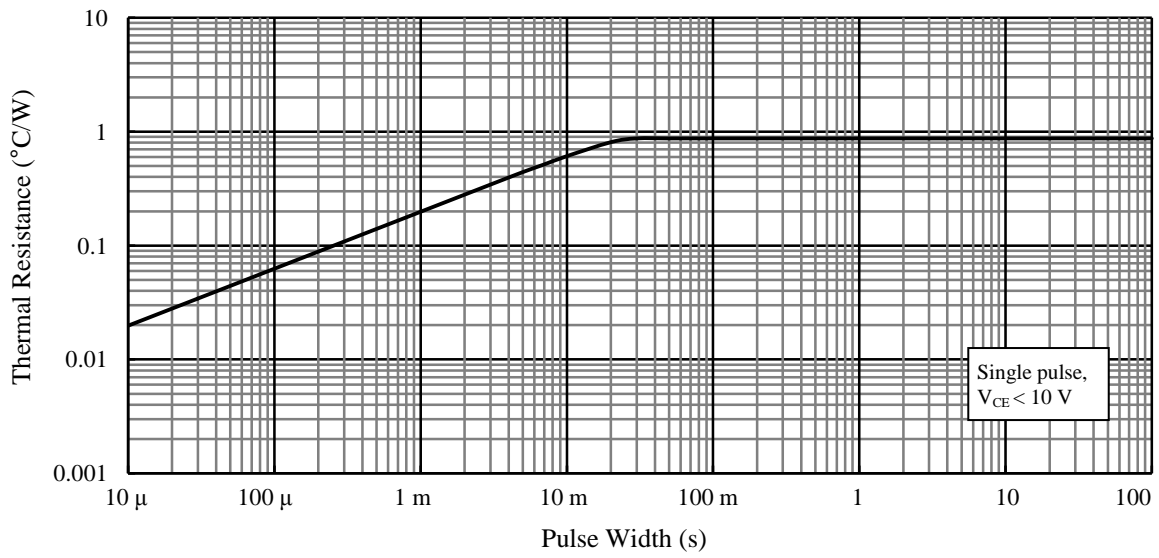
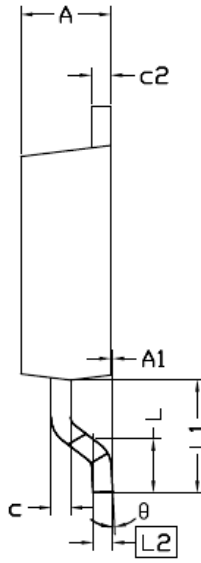
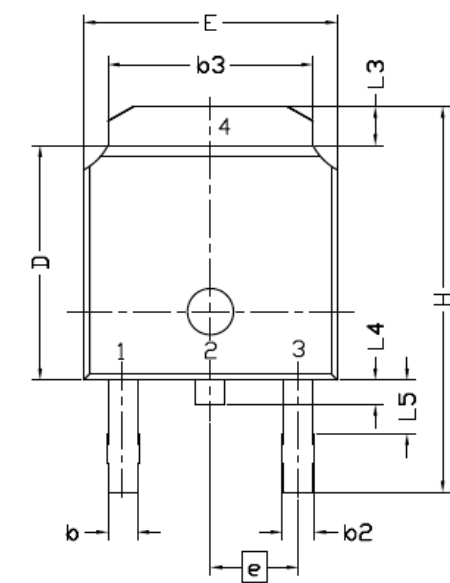


Figure 16. Transient Thermal Resistance

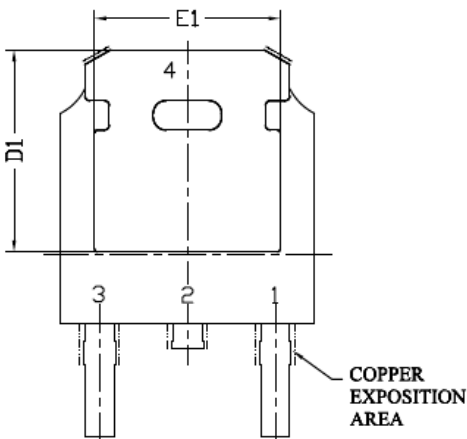
DGU4520GR

Physical Dimensions

● TO252



SYMBOL	DIMENSIONAL REQMTS		
	MIN	NOM	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
- Bare lead frame: Pb-free (RoHS compliant)
- Excludes mold flash mold flash, protrusion or gate burrs.
- When soldering the products, it is required to minimize the working time within the following limits:

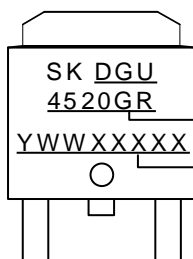
Reflow

Preheat: 180 °C / 90 ± 30 s

Solder heating: 250 °C / 10 ± 1s, 2 times (260 °C peak)

Soldering Iron: 380 ± 10 °C / 3.5 ± 0.5 s, 1 time

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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