

BV_{CES}	400±30V
I_C	31A
$V_{CE(sat)}$ (Typ.)	1.6V
E_{AS}	320mJ

●Features

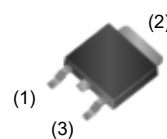
- 1) Low Collector - Emitter Saturation Voltage
- 2) High Self-Clamped Inductive Switching Energy
- 3) Built in Gate-Emitter Protection Diode
- 4) Built in Gate-Emitter Resistance
- 5) Qualified to AEC-Q101
- 6) Pb - free Lead Plating ; RoHS Compliant

●Application

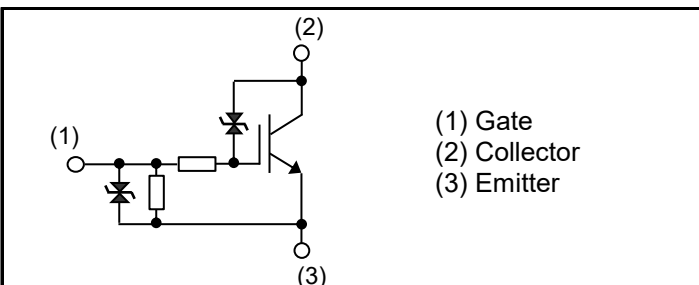
- Ignition Coil Driver Circuits
- Solenoid Driver Circuits

●Outline

TO-252



●Inner circuit



●Packaging specifications

Type	Packing	Taping
	Reel size (mm)	330
	Tape width (mm)	16
	Basic ordering unit (pcs)	2,500
	Taping code	TL
	Marking	RGPR31BM40

●Absolute Maximum Ratings (at $T_C = 25^\circ\text{C}$ unless otherwise specified)

Parameter		Symbol	Value	Unit
Collector - Emitter Voltage		V_{CES}	430	V
Emitter - Collector Voltage ($V_{GE} = 0\text{V}$)		V_{EC}	25	V
Gate - Emitter Voltage		V_{GE}	±10	V
Collector Current		I_C	31	A
Avalanche Energy (Single Pulse)	$T_j = 25^\circ\text{C}$	E_{AS}	320	mJ
	$T_j = 150^\circ\text{C}$	E_{AS}^{*2}	185	mJ
Power Dissipation		P_D	142	W
Operating Junction Temperature		T_j	-40 to +175	$^\circ\text{C}$
Storage Temperature		T_{stg}	-55 to +175	$^\circ\text{C}$

●Thermal resistance

Datasheet

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal Resistance IGBT Junction - Case	$R_{\theta(j-c)}$	-	-	1.05	°C/W

●Electrical characteristics (at $T_j = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Collector - Emitter Breakdown Voltage	BV_{CES}	$I_C = 2\text{mA}, V_{GE} = 0\text{V}$	370	400	430	V
		$T_j = -40 \text{ to } 150^\circ\text{C}^{*2}$	365	-	435	
Emitter - Collector Breakdown Voltage	BV_{EC}	$I_C = -20\text{mA}, V_{GE} = 0\text{V}$ $T_j = -40 \text{ to } 150^\circ\text{C}^{*2}$	28	-	-	V
Gate - Emitter Breakdown Voltage	BV_{GES}	$I_G = \pm 2\text{mA}, V_{CE} = 0\text{V}$ $T_j = -40 \text{ to } 150^\circ\text{C}^{*2}$	± 12	-	± 17	V
Collector Cut - off Current	I_{CES}	$V_{CE} = 300\text{V}, V_{GE} = 0\text{V}$ $T_j = 25^\circ\text{C}$	-	-	25	μA
		$T_j = 150^\circ\text{C}^{*2}$	-	-	1	mA
Gate - Emitter Leakage Current	I_{GES}	$V_{GE} = \pm 10\text{V}, V_{CE} = 0\text{V}$	± 0.4	± 0.6	± 1.2	mA
Gate - Emitter Threshold Voltage	$V_{GE(th)}$	$V_{CE} = 5\text{V}, I_C = 14\text{mA}$ $T_j = 25^\circ\text{C}$	1.3	1.7	2.1	V
		$T_j = 150^\circ\text{C}^{*2}$	-	1.3	-	V
Gate - Emitter Threshold Voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C = 1\text{mA}$ $T_j = -40 \text{ to } 150^\circ\text{C}^{*2}$	0.6	-	2.2	V
Collector - Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 14\text{A}, V_{GE} = 5\text{V}$ $T_j = 25^\circ\text{C}$	-	1.60	2.00	V
		$T_j = 150^\circ\text{C}^{*2}$	-	1.80	-	V
Collector - Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 5.5\text{A}, V_{GE} = 4.5\text{V}$ $T_j = 25^\circ\text{C}$	-	1.17	1.50	V
		$T_j = 150^\circ\text{C}^{*2}$	-	1.13	-	V

●Electrical characteristics (at $T_j = 25^\circ\text{C}$ unless otherwise specified)

Datasheet

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Collector - Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 14\text{A}$, $V_{GE} = 4\text{V}$ $T_j = 25^\circ\text{C}$	-	1.70	2.10	V
		$T_j = 150^\circ\text{C}$	-	1.90	-	V
Input Capacitance	C_{ies}	$V_{CE} = 10\text{V}$	-	1470	-	pF
Output Capacitance	C_{oes}	$V_{GE} = 0\text{V}$	-	256	-	
Reverse transfer Capacitance	C_{res}	$f = 1\text{MHz}$	-	85	-	
Total Gate Charge	Q_g	$V_{CE} = 12\text{V}$, $I_C = 10\text{A}$, $V_{GE} = 5\text{V}$	-	23	-	nC
Turn - on Delay Time ^{*1,*2}	$t_{d(on)}$	$I_C = 8\text{A}$, $V_{CC} = 300\text{V}$, $V_{GE} = 5\text{V}$, $R_G = 100\Omega$, $L = 5\text{mH}$, $T_j = 25^\circ\text{C}$	0.13	0.21	0.60	μs
Rise Time ^{*1,*2}	t_r		0.10	0.18	0.50	
Turn - off Delay Time ^{*1,*2}	$t_{d(off)}$		1.1	1.6	4.0	
Fall Time ^{*1,*2}	t_f		1.0	2.1	5.8	
Turn - on Delay Time ^{*1,*2}	$t_{d(on)}$	$I_C = 8\text{A}$, $V_{CC} = 300\text{V}$, $V_{GE} = 5\text{V}$, $R_G = 100\Omega$, $L = 5\text{mH}$, $T_j = 150^\circ\text{C}$	-	0.19	-	μs
Rise Time ^{*1,*2}	t_r		-	0.21	-	
Turn - off Delay Time ^{*1,*2}	$t_{d(off)}$		-	2.0	-	
Fall Time ^{*1,*2}	t_f		-	3.7	-	
Avalanche Energy (Single Pulse)	E_{AS}	$L = 5\text{mH}$, $V_{GE} = 5\text{V}$, $V_{CC} = 30\text{V}$, $R_G = 1\text{k}\Omega$ $T_j = 25^\circ\text{C}$	320	-	-	mJ
		$T_j = 150^\circ\text{C}^{*2}$	185	-	-	mJ
Gate Series Resistance	R_G		50	-	140	Ω
Gate - Emitter Resistance	R_{GE}		11	16	22	k Ω

*1) Assurance items according to our measurement definition (Fig.18)

*2) Design assurance items

●Electrical characteristic curves

Fig.1 Typical Output Characteristics

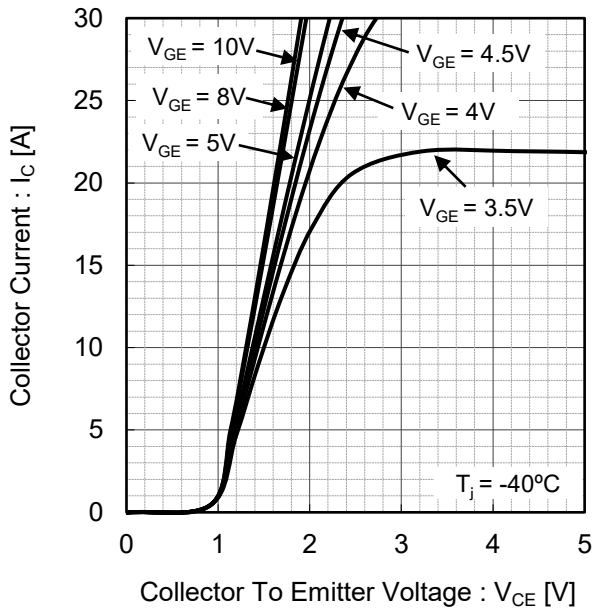


Fig.2 Typical Output Characteristics

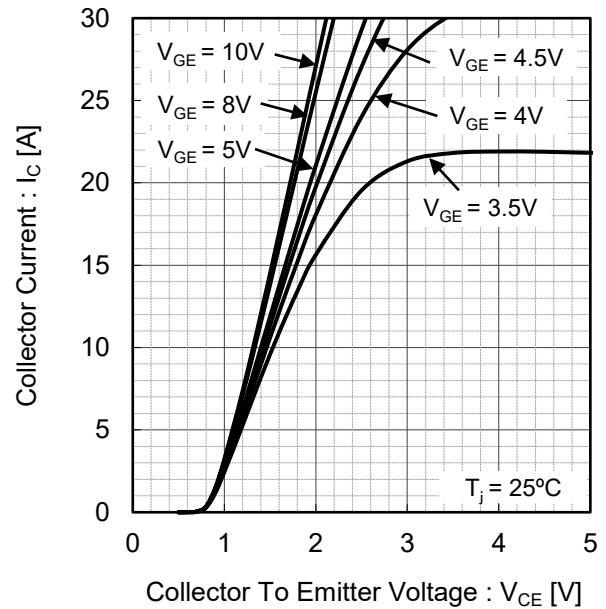


Fig.3 Typical Output Characteristics

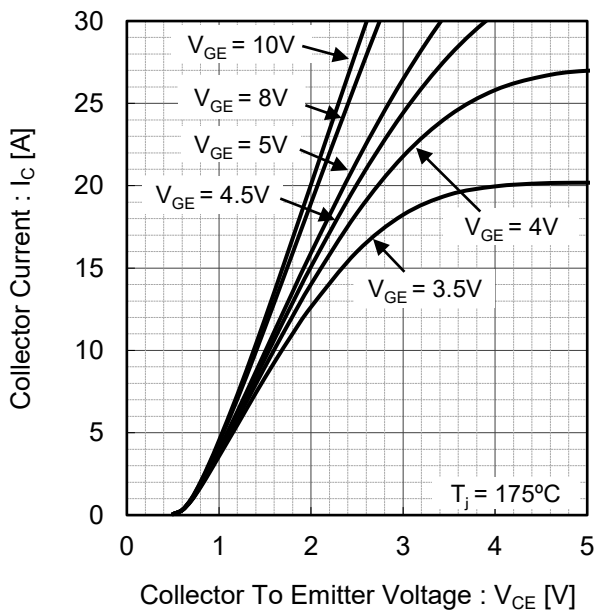
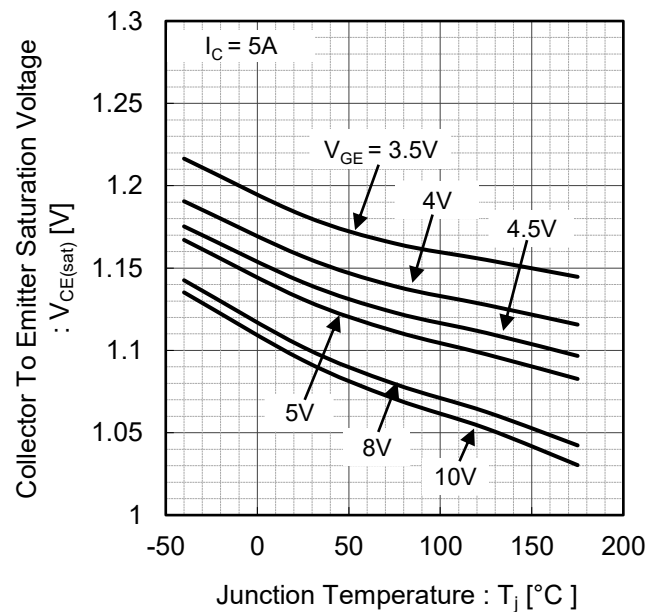


Fig.4 Typical Collector To Emitter Saturation Voltage vs. Junction Temperature



●Electrical characteristic curves

Fig.5 Typical Collector To Emitter Saturation Voltage vs. Junction Temperature

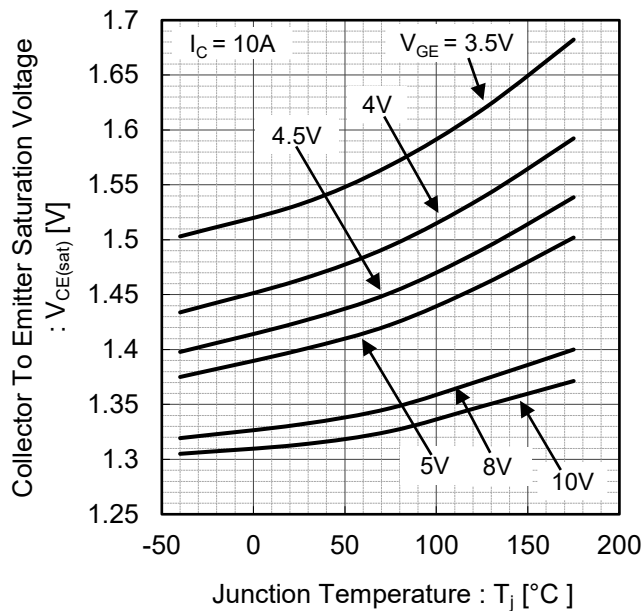


Fig.6 Typical Collector To Emitter Saturation Voltage vs. Junction Temperature

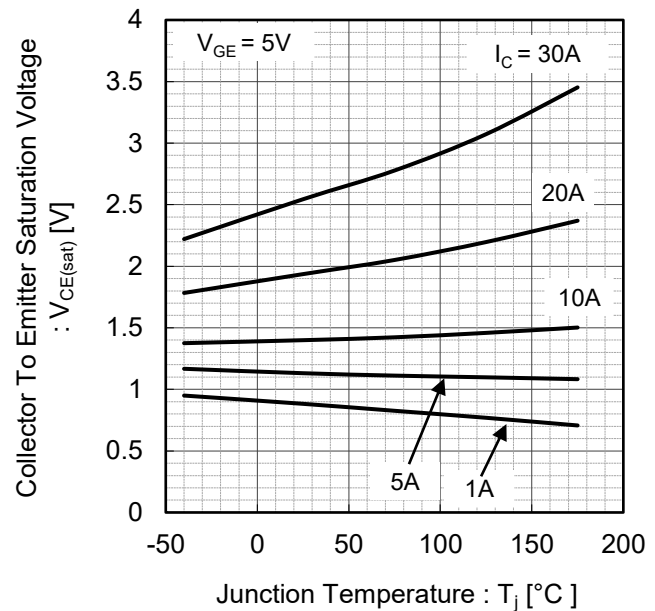


Fig.7 Typical Transfer Characteristics

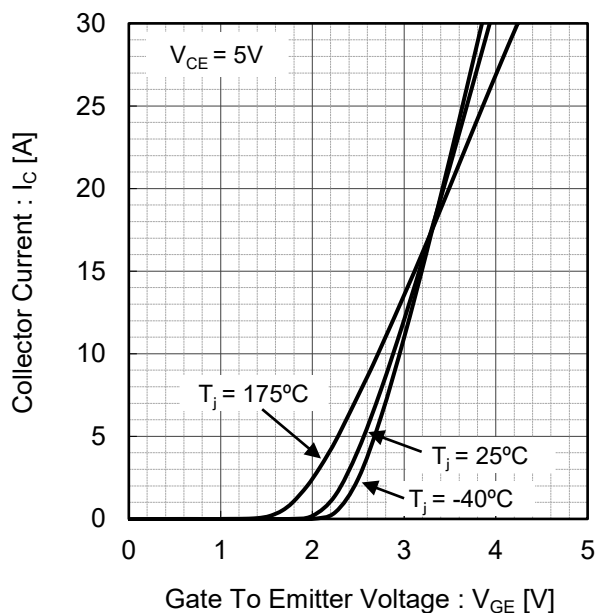
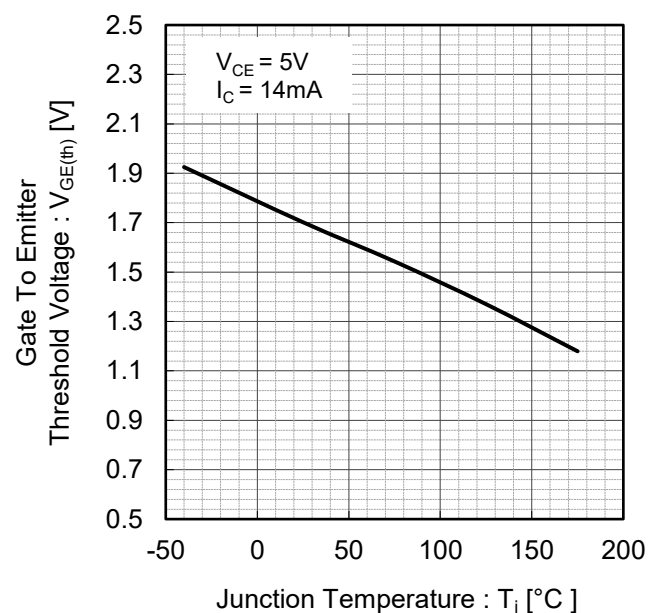


Fig.8 Typical Gate To Emitter Threshold Voltage vs. Junction Temperature



●Electrical characteristic curves

Fig.9 Typical Leakage Current vs. Junction Temperature

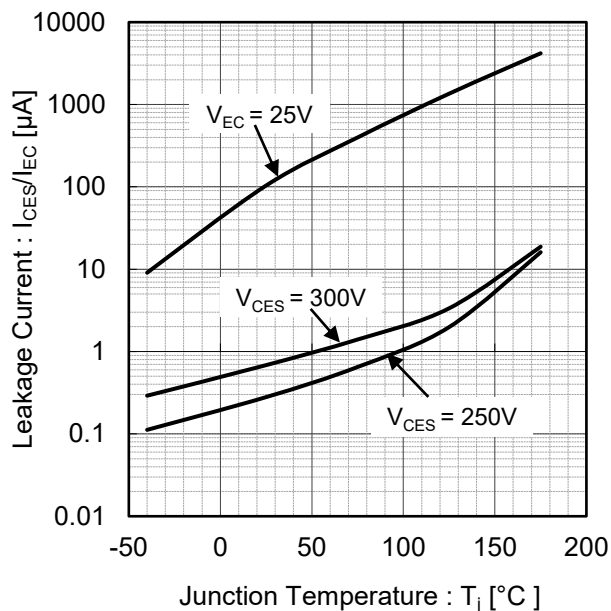


Fig.10 Typical Collector To Emitter Breakdown Voltage vs. Junction Temperature

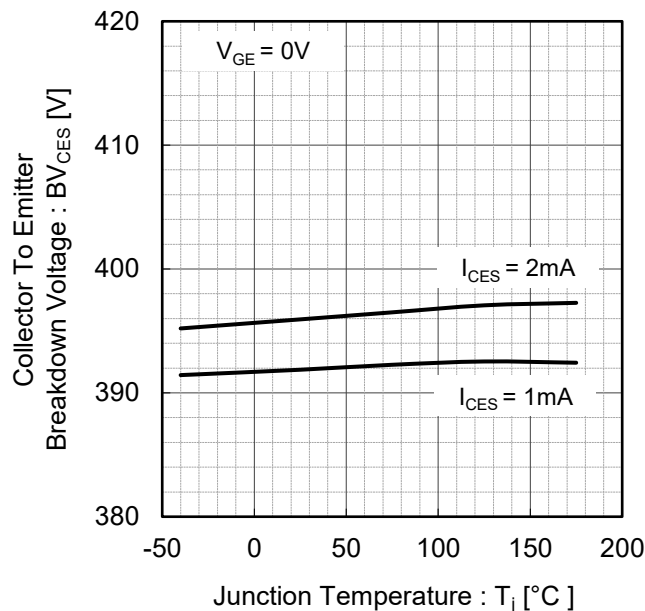


Fig.11 Typical Self Clamped Inductive Switching Current vs. Inductance

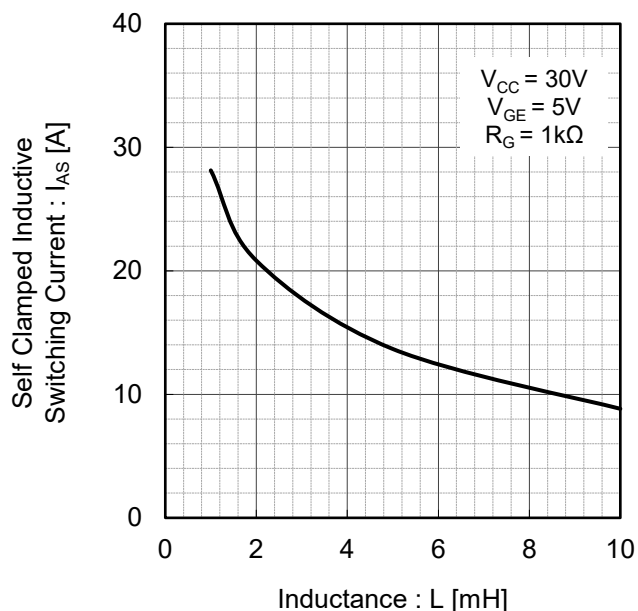
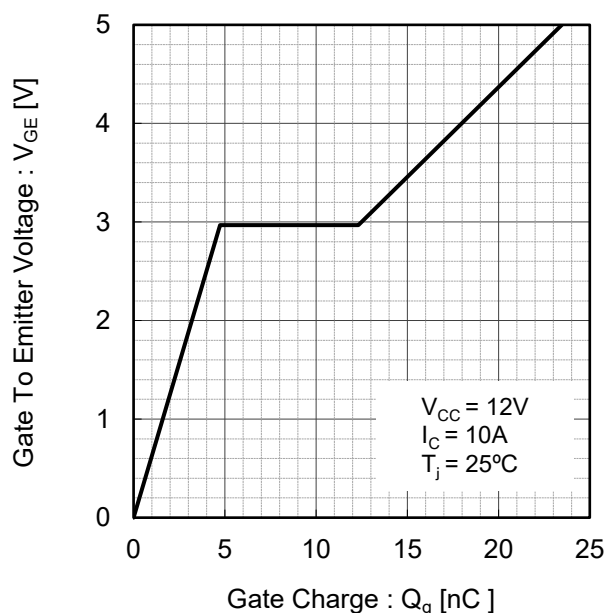


Fig.12 Typical Gate Charge



●Electrical characteristic curves

Fig.13 Typical Capacitance
vs. Collector To Emitter Voltage

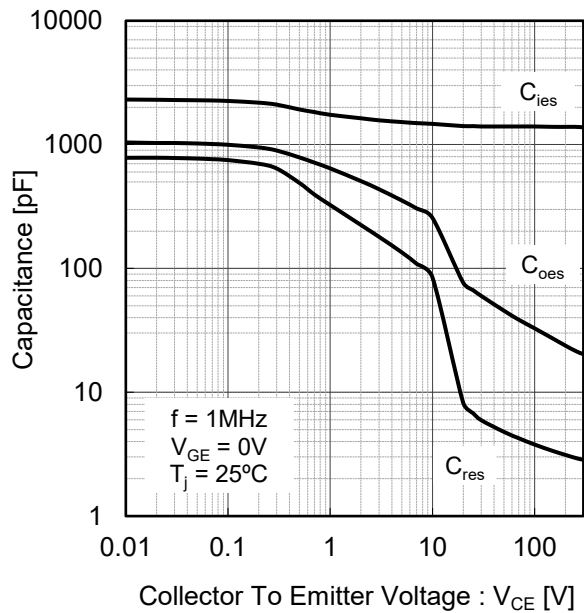


Fig.14 Typical Switching Time
vs. Junction Temperature

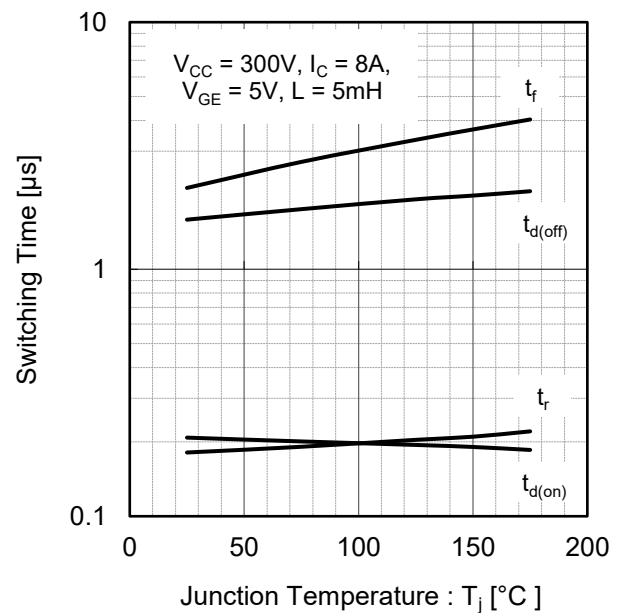
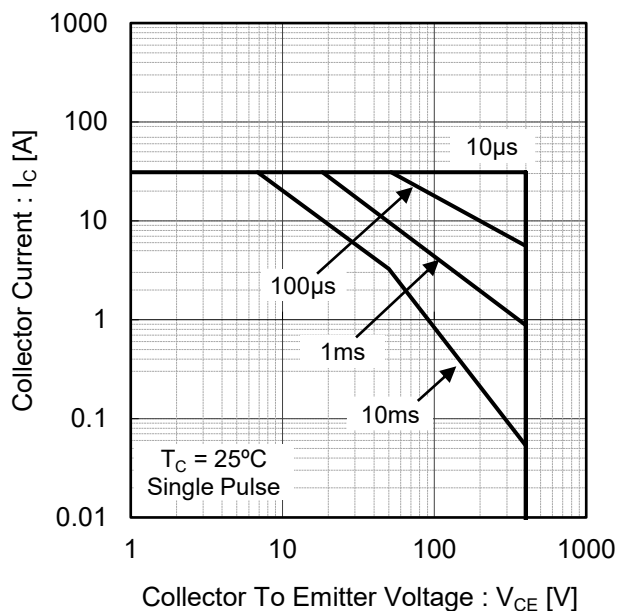
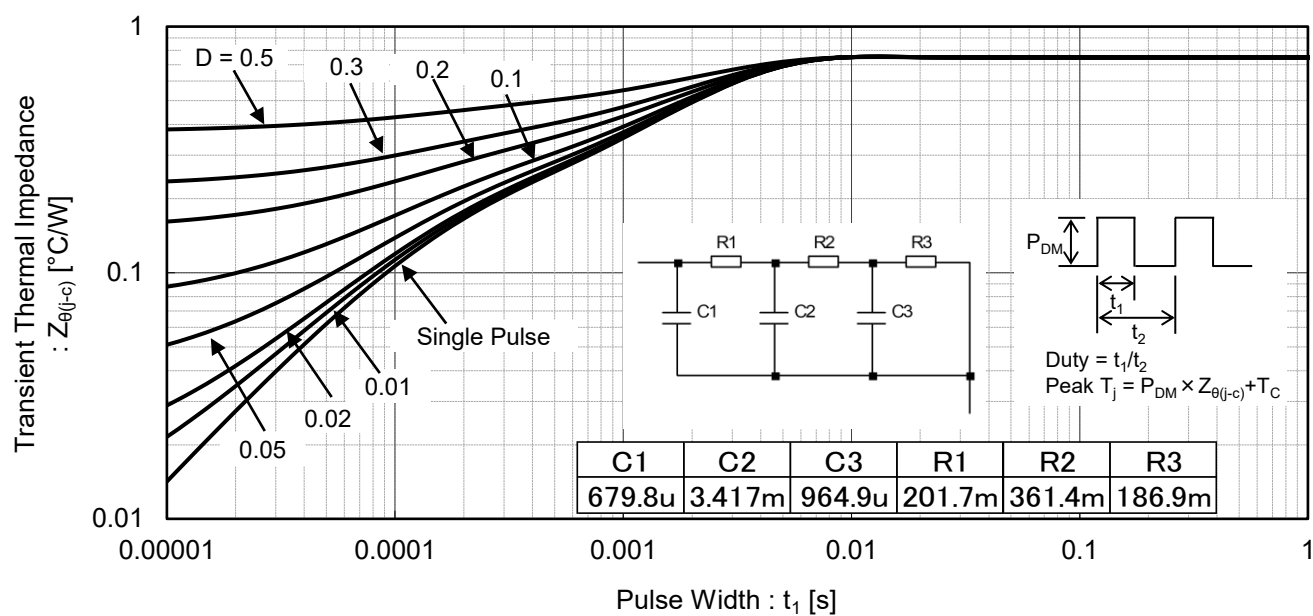


Fig.15 Forward Bias Safe Operating Area



●Electrical characteristic curves

Fig.16 Transient Thermal Impedance



●Inductive Load Switching Circuit and Waveform

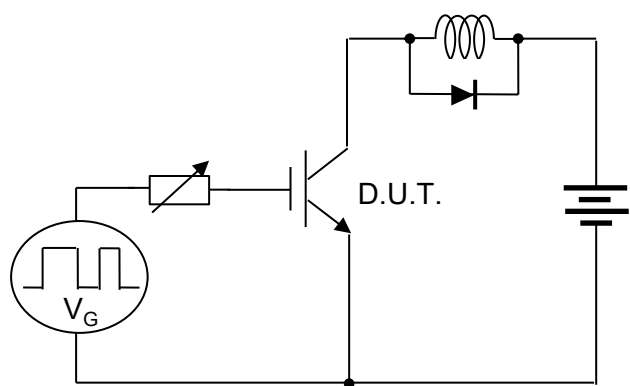


Fig.17 Inductive Load Switching Circuit

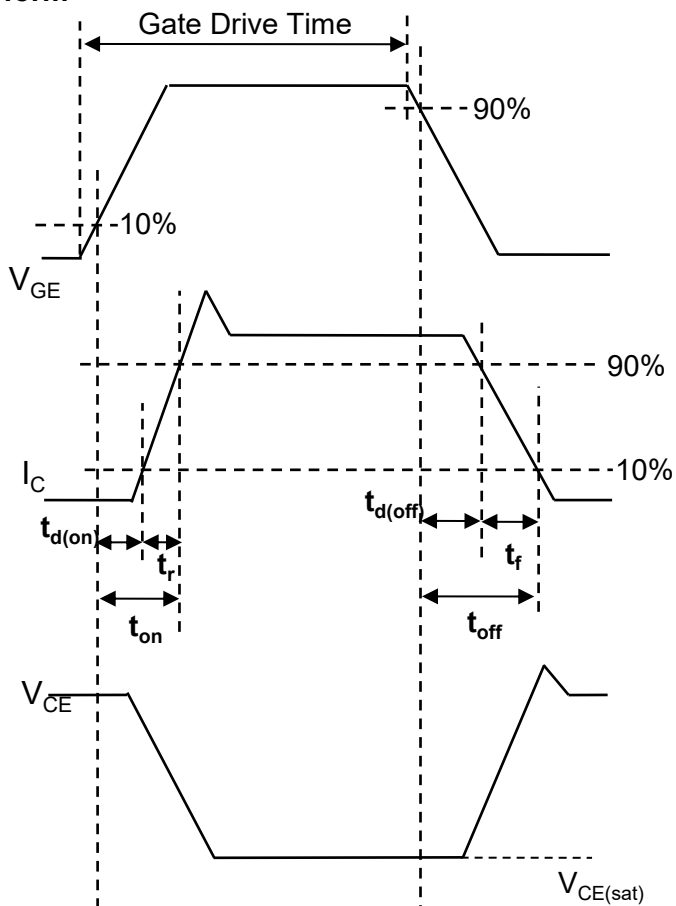


Fig.18 Inductive Load Switching Waveform

●Self Clamped Inductive Switching Circuit and Waveform

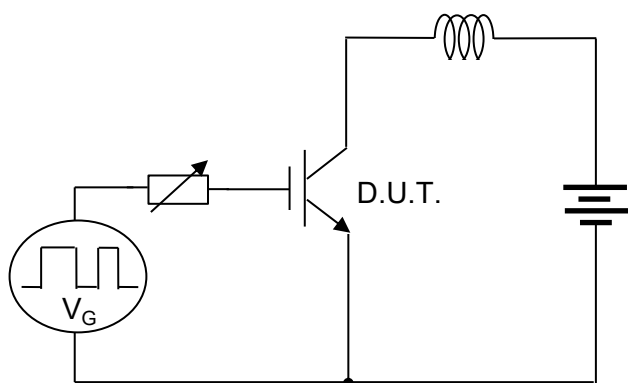


Fig.19 Self Clamped Inductive Switching Circuit

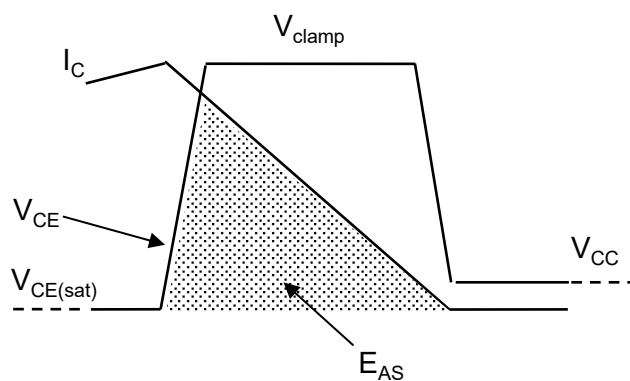


Fig.20 Self Clamped Inductive Switching Waveform

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