

BV_{CES}	450±30V
I_C	45A
$V_{CE(sat)}$ (Typ.)	1.6V
E_{AS}	500mJ

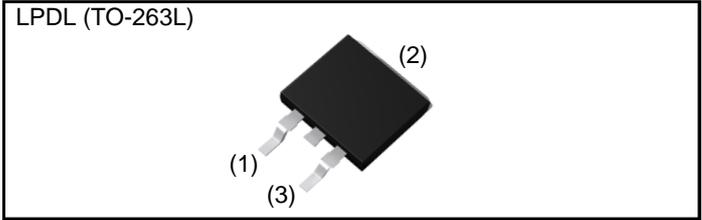
●Features

- 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

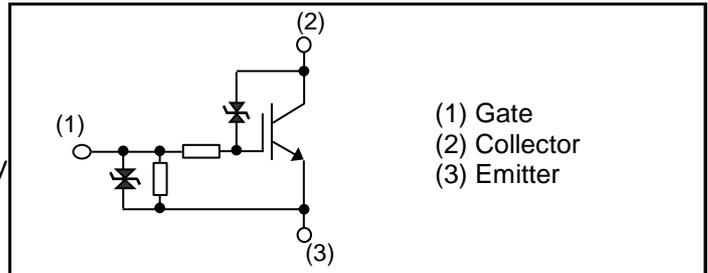
●Application

- Ignition Coil Driver Circuits
- Solenoid Driver Circuits

●Outline



●Inner circuit



●Packaging specifications

Type	Packing	Taping
	Reel size (mm)	330
Tape width (mm)	24	
Basic ordering unit (pcs)	1,000	
Taping code	TL	
Marking	RGPR50NL45	

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

Parameter	Symbol	Value	Unit	
Collector - Emitter Voltage	V_{CES}	480	V	
Emitter-Collector Voltage ($V_{GE} = 0V$)	V_{EC}	25	V	
Gate - Emitter Voltage	V_{GE}	±10	V	
Collector Current	I_C	45	A	
Avalanche Energy (Single Pulse)	$T_j = 25^\circ\text{C}$	E_{AS}	500	mJ
	$T_j = 150^\circ\text{C}$	E_{AS}^{*2}	250	mJ
Power Dissipation	P_D	187	W	
Operating Junction Temperature	T_j	-40 to +175	$^\circ\text{C}$	
Storage Temperature	T_{stg}	-55 to +175	$^\circ\text{C}$	

●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal Resistance IGBT Junction - Case	$R_{\theta(j-c)}$	-	-	0.80	°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}	$I_C = 2\text{mA}, V_{GE} = 0\text{V},$ $T_j = 25^\circ\text{C}$	420	450	480	V
		$T_j = -40 \text{ to } 175^\circ\text{C}^{*2}$	415	-	485	
Gate - Emitter Breakdown Voltage	BV_{EC}	$I_C = -10\text{mA}, V_{GE} = 0\text{V}$	25	35	-	V
Gate - Emitter Breakdown Voltage	BV_{GES}	$I_G = \pm 5\text{mA}, V_{CE} = 0\text{V}$	± 12	-	± 17	V
Collector Cut - off Current	I_{CES}	$V_{CE} = 300\text{V}, V_{GE} = 0\text{V},$ $T_j = 25^\circ\text{C}$	-	-	7	μA
		$T_j = 150^\circ\text{C}^{*2}$	-	-	100	μA
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	$V_{GE(th)}$	$V_{CE} = 5\text{V}, I_C = 23\text{mA},$ $T_j = 25^\circ\text{C}$	1.3	1.7	2.1	V
		$T_j = 150^\circ\text{C}^{*2}$	-	1.3	-	V
Collector - Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 23\text{A}, V_{GE} = 5\text{V},$ $T_j = 25^\circ\text{C}$	-	1.60	2.00	V
		$T_j = 150^\circ\text{C}^{*2}$	-	1.80	-	V
Collector - Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 9.2\text{A}, V_{GE} = 4.5\text{V},$ $T_j = 25^\circ\text{C}$	-	1.20	1.50	V
		$T_j = 150^\circ\text{C}^{*2}$	-	1.17	-	V
Collector - Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 23\text{A}, V_{GE} = 4\text{V},$ $T_j = 25^\circ\text{C}$	-	1.70	2.10	V
		$T_j = 150^\circ\text{C}^{*2}$	-	2.00	-	V

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input Capacitance	C_{ies}	$V_{CE} = 10\text{V}$, $V_{GE} = 0\text{V}$, $f = 1\text{MHz}$	-	2400	-	pF
Output Capacitance	C_{oes}		-	431	-	
Reverse transfer Capacitance	C_{res}		-	150	-	
Total Gate Charge	Q_g	$V_{CE} = 12\text{V}$, $I_C = 10\text{A}$, $V_{GE} = 5\text{V}$	-	40	-	nC
Turn - on Delay Time ^{*1,*2}	$t_{d(on)}$	$I_C = 8\text{A}$, $V_{CC} = 300\text{V}$, $V_{GE} = 5\text{V}$, $R_G = 100\Omega$, $L = 5\text{mH}$, $T_j = 25^\circ\text{C}$	0.19	0.27	0.60	μs
Rise Time ^{*1,*2}	t_r		0.10	0.18	0.50	
Turn - off Delay Time ^{*1,*2}	$t_{d(off)}$		1.90	2.40	5.00	
Fall Time ^{*1,*2}	t_f		1.00	2.00	5.60	
Turn - on Delay Time ^{*1}	$t_{d(on)}$	$I_C = 8\text{A}$, $V_{CC} = 300\text{V}$, $V_{GE} = 5\text{V}$, $R_G = 100\Omega$, $L = 5\text{mH}$, $T_j = 150^\circ\text{C}$	-	0.25	-	μs
Rise Time ^{*1}	t_r		-	0.22	-	
Turn - off Delay Time ^{*1}	$t_{d(off)}$		-	3.10	-	
Fall Time ^{*1}	t_f		-	3.50	-	
Avalanche Energy (Single Pulse)	E_{AS}	$L = 5\text{mH}$, $V_{GE} = 5\text{V}$, $V_{CC} = 30\text{V}$, $R_G = 1\text{k}\Omega$, $T_j = 25^\circ\text{C}$	500	-	-	mJ
		$T_j = 150^\circ\text{C}$ ^{*2}	250	-	-	mJ
Gate Series Resistance	R_G		70	100	130	Ω
Gate - Emitter Resistance	R_{GE}		8	16	24	k Ω

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

*2) Design assurance items

●Electrical characteristic curves

Fig.1 Typical Output Characteristics

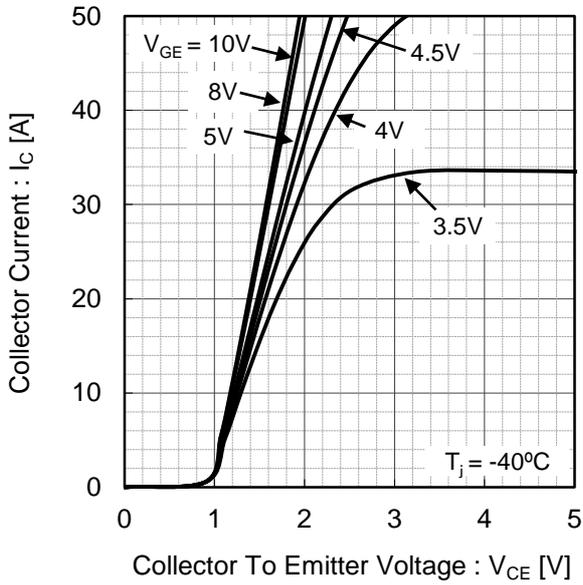


Fig.2 Typical Output Characteristics

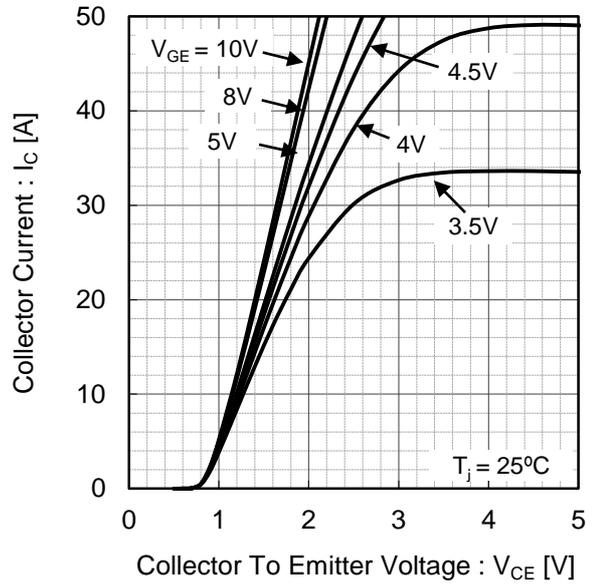


Fig.3 Typical Output Characteristics

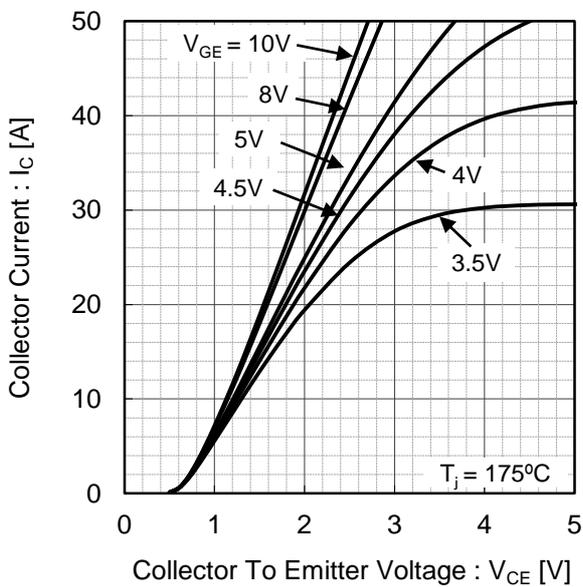
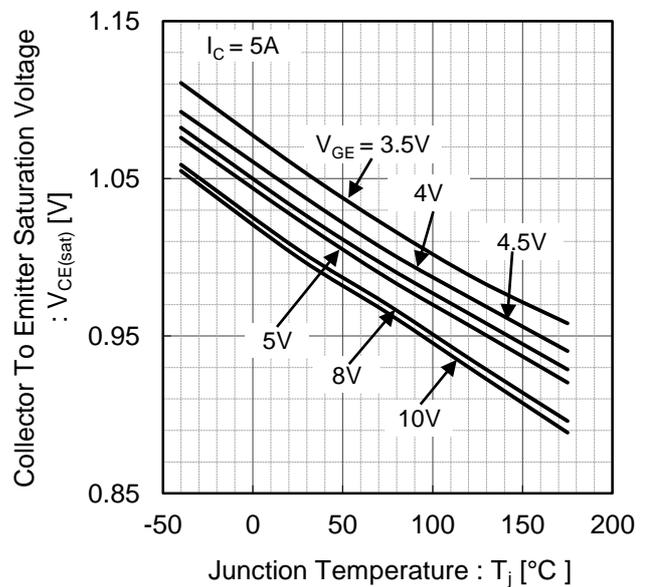


Fig.4 Typical Collector To Emitter Saturation Voltage vs. Junction Temperature



●Electrical characteristic curves

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

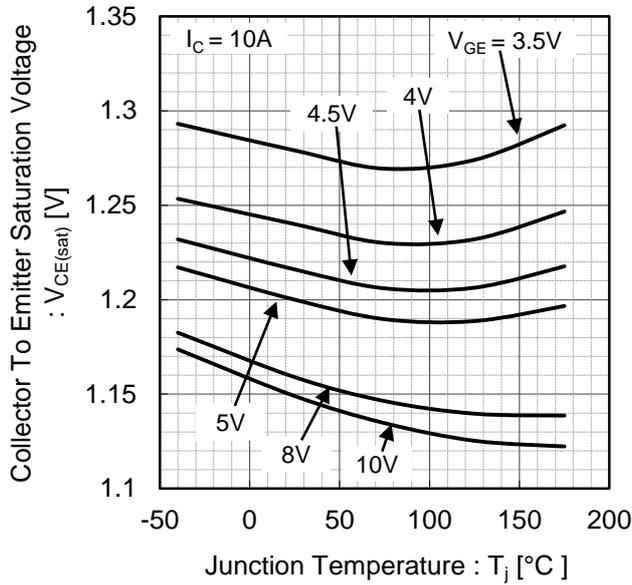


Fig.6 Typical Collector To Emitter Saturation Voltage vs. Junction Temperature

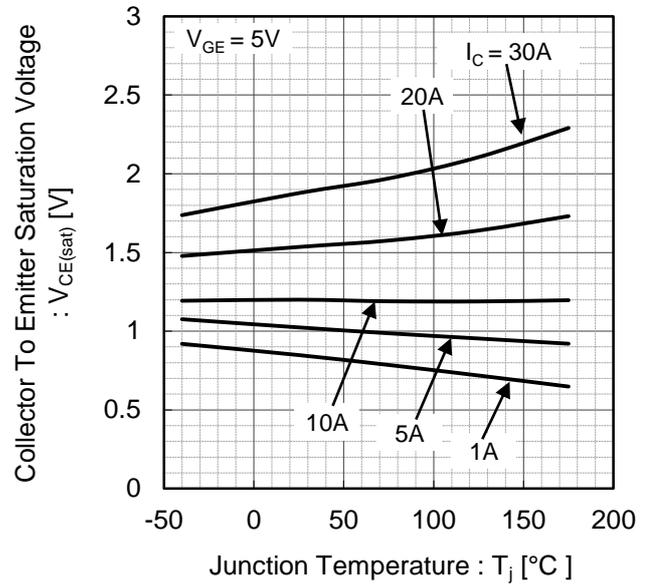


Fig.7 Typical Transfer Characteristics

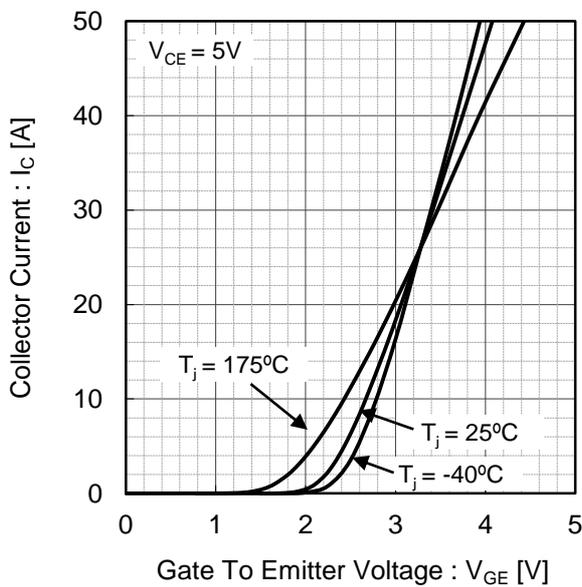
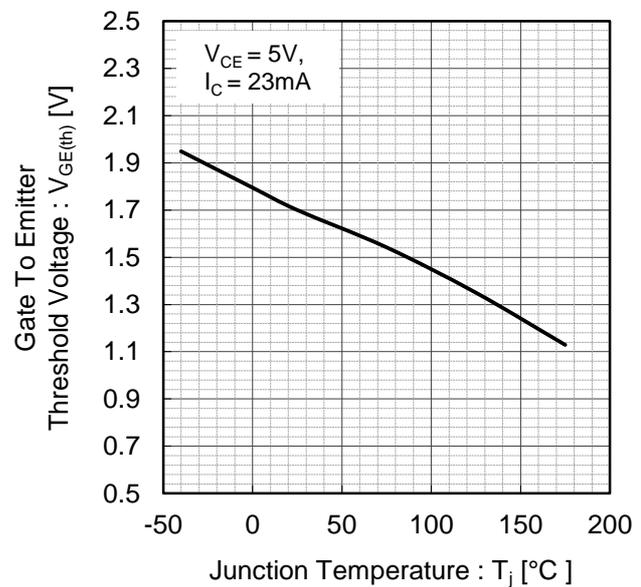


Fig.8 Typical Gate To Emitter Threshold Voltage vs. Junction Temperature



●Electrical characteristic curves

Fig.9 Typical Leakage Current vs. Junction Temperature

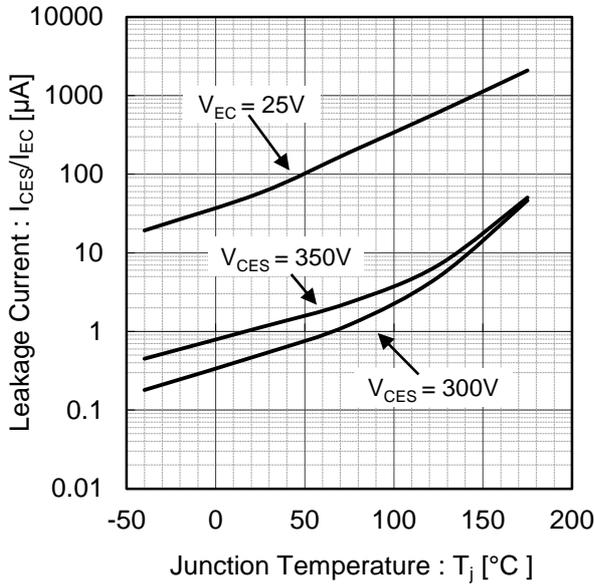


Fig.10 Typical Collector To Emitter Breakdown Voltage vs. Junction Temperature

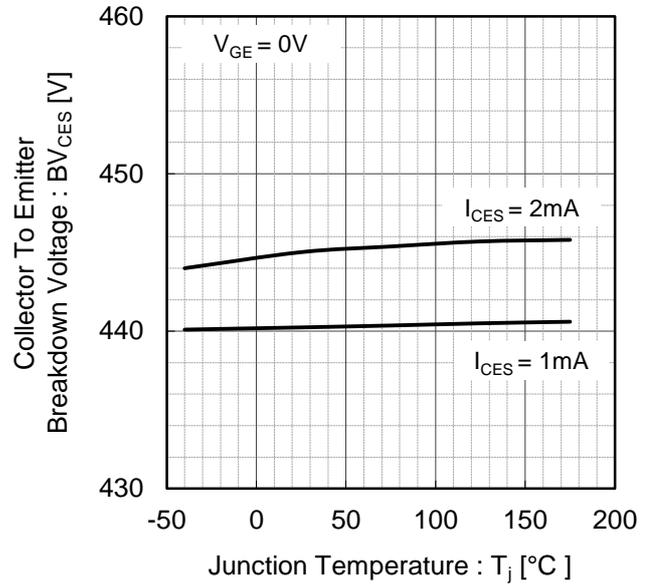


Fig.11 Typical Self Clamped Inductive Switching Current vs. Inductance

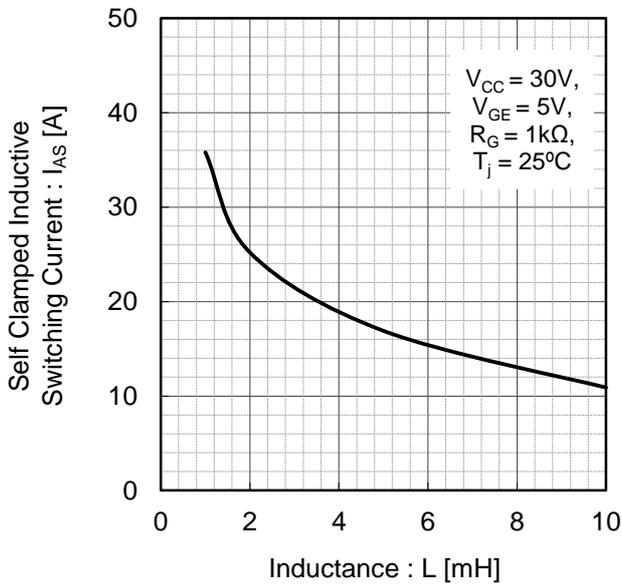
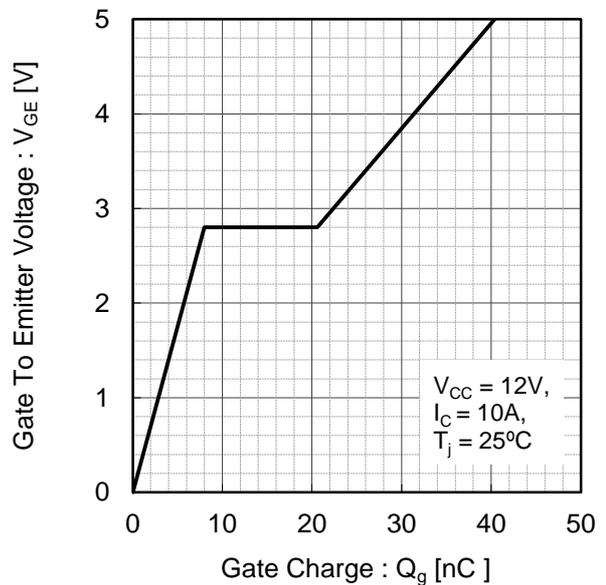


Fig.12 Typical Gate Charge



●Electrical characteristic curves

Fig.13 Typical Capacitance vs. Collector To Emitter Voltage

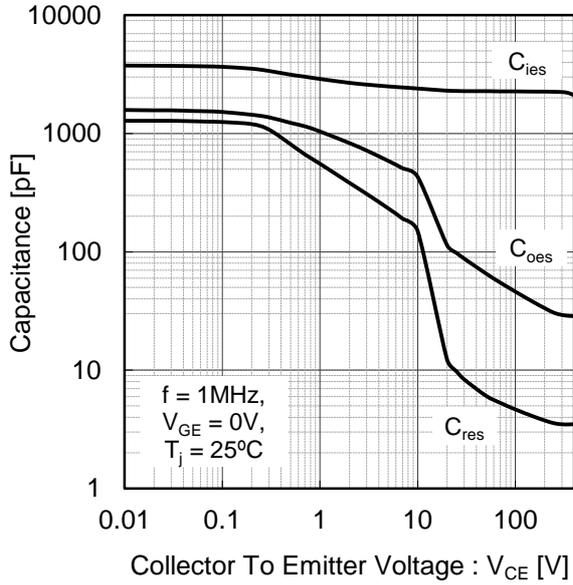


Fig.14 Typical Switching Time vs. Junction Temperature

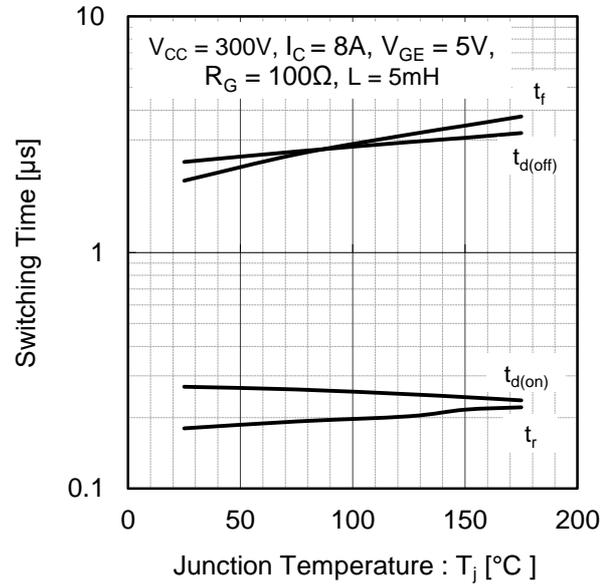
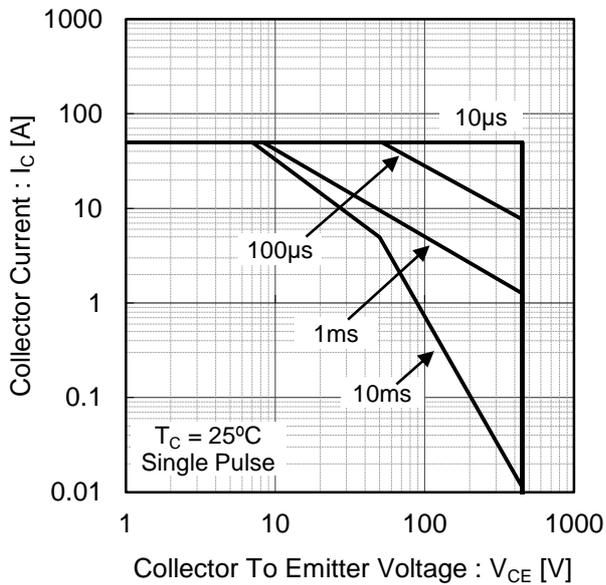
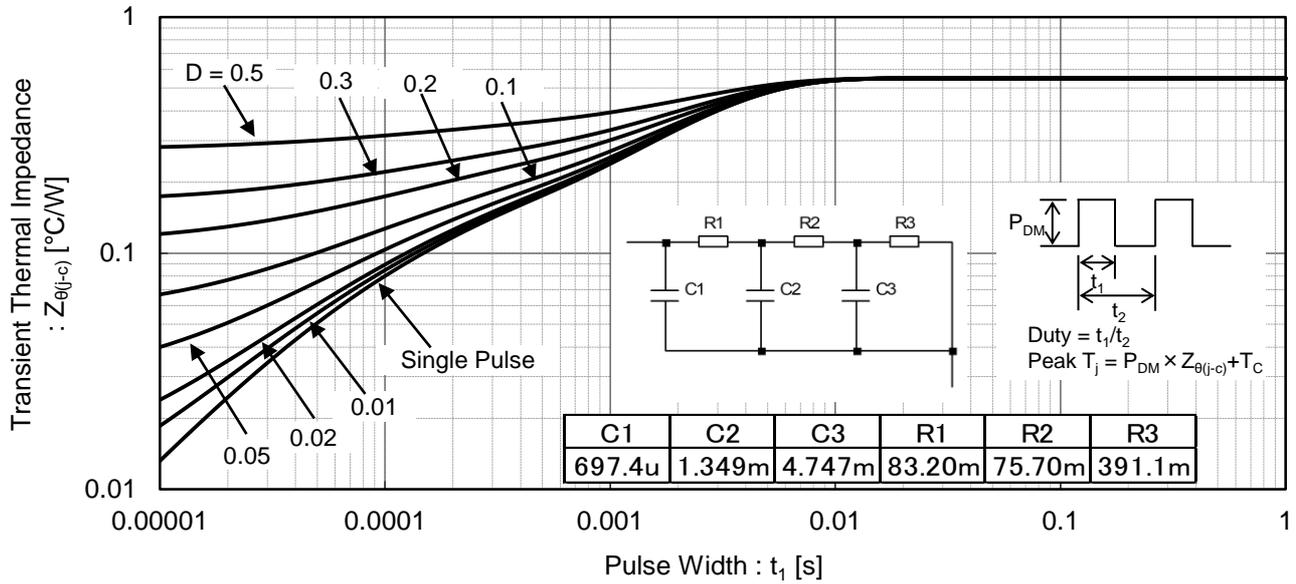


Fig.15 Forward Bias Safe Operating Area



●Electrical characteristic curves

Fig.16 Transient Thermal Impedance



●Inductive Load Switching Circuit and Waveform

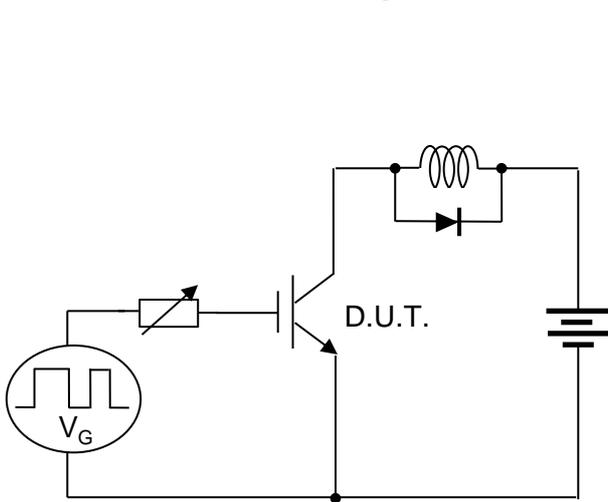


Fig.17 Inductive Load Switching Circuit

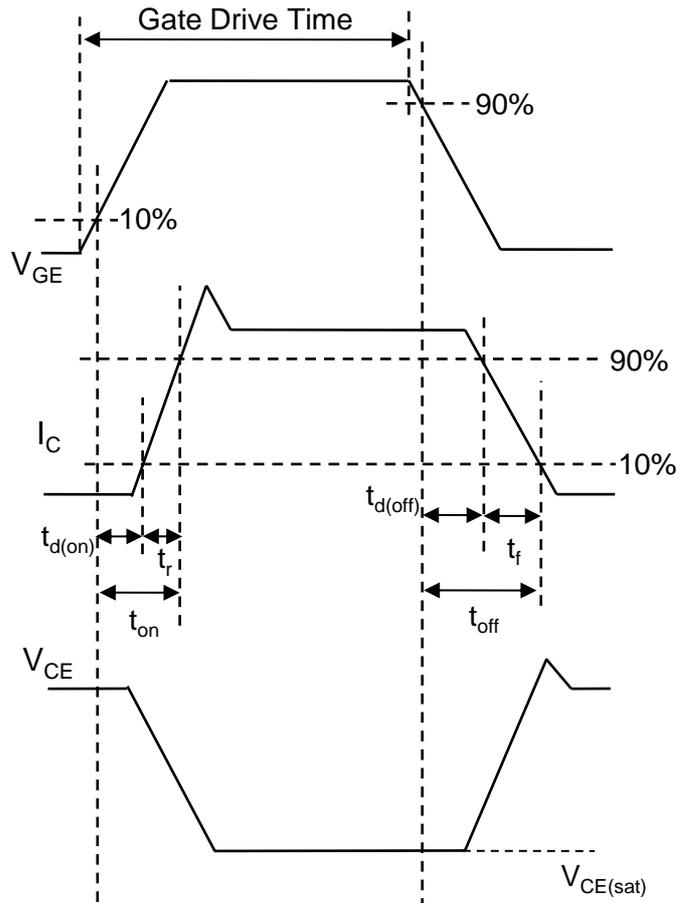


Fig.18 Inductive Load Switching Waveform

●Self Clamped Inductive Switching Circuit and Waveform

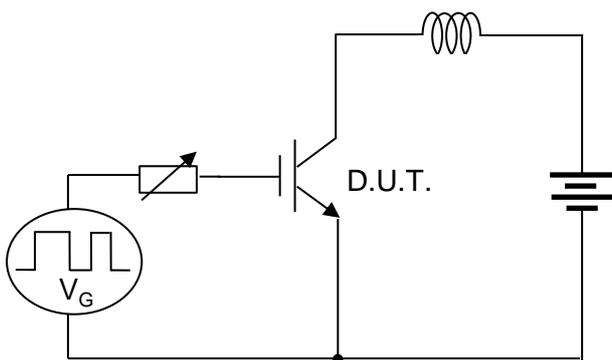


Fig.19 Self Clamped Inductive Switching Circuit

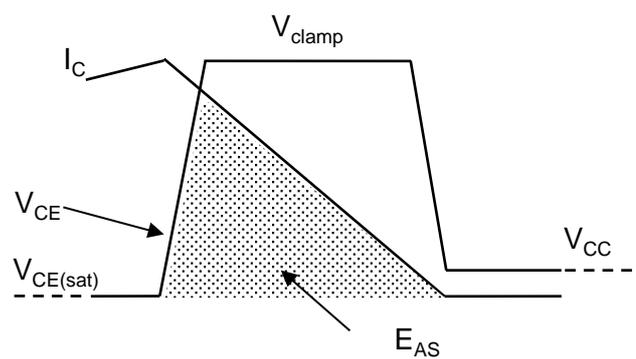


Fig.20 Self Clamped Inductive Switching Waveform

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