

V_{CES}	650V
I_C (100°C)	30A
$V_{CE(sat)}$ (Typ.)	1.5V
P_D	178W

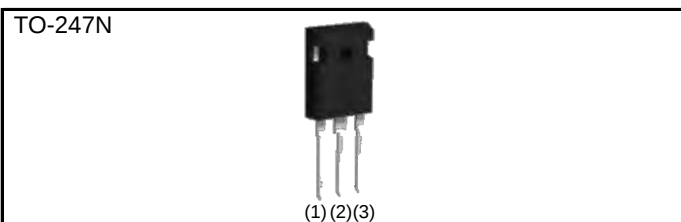
●Features

- 1) AEC-Q101 Qualified
- 2) Low Collector - Emitter Saturation Voltage
- 3) Low Switching Loss & Soft Switching
- 4) Pb - free Lead Plating ; RoHS Compliant

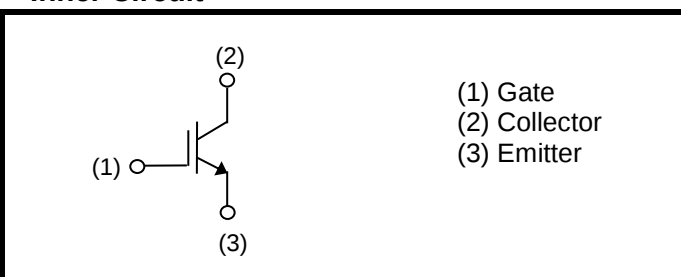
●Application

Automotive
On & Off Board Chargers
DC-DC Converters
PFC
Industrial Inverter

●Outline



●Inner Circuit



●Packaging Specifications

Type	Packaging	Tube
	Reel Size (mm)	-
	Tape Width (mm)	-
	Basic Ordering Unit (pcs)	450
	Packing Code	C11
	Marking	RGW60TS65

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

Parameter		Symbol	Value	Unit
Collector - Emitter Voltage		V_{CES}	650	V
Gate - Emitter Voltage		V_{GES}	± 30	V
Collector Current	$T_C = 25^\circ\text{C}$	I_C	64	A
	$T_C = 100^\circ\text{C}$	I_C	39	A
Pulsed Collector Current		I_{CP}^{*1}	120	A
Power Dissipation	$T_C = 25^\circ\text{C}$	P_D	178	W
	$T_C = 100^\circ\text{C}$	P_D	89	W
Operating Junction Temperature		T_j	-40 to +175	$^\circ\text{C}$
Storage Temperature		T_{stg}	-55 to +175	$^\circ\text{C}$

*1 Pulse width limited by T_{jmax} .

●Thermal Resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal Resistance IGBT Junction - Case	$R_{\theta(j-c)}$	-	-	0.84	°C/W

●IGBT 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}	$I_C = 10\mu\text{A}$, $V_{GE} = 0\text{V}$	650	-	-	V
Collector Cut - off Current	I_{CES}	$V_{CE} = 650\text{V}$, $V_{GE} = 0\text{V}$	-	-	10	μA
Gate - Emitter Leakage Current	I_{GES}	$V_{GE} = \pm 30\text{V}$, $V_{CE} = 0\text{V}$	-	-	± 200	nA
Gate - Emitter Threshold Voltage	$V_{GE(th)}$	$V_{CE} = 5\text{V}$, $I_C = 20.0\text{mA}$	5.0	6.0	7.0	V
Collector - Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 30\text{A}$, $V_{GE} = 15\text{V}$, $T_j = 25^\circ\text{C}$	-	1.5	1.9	V
		$T_j = 175^\circ\text{C}$	-	1.85	-	

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input Capacitance	C_{ies}	$V_{CE} = 30\text{V}$,	-	2530	-	pF
Output Capacitance	C_{oes}	$V_{GE} = 0\text{V}$,	-	65	-	
Reverse transfer Capacitance	C_{res}	$f = 1\text{MHz}$	-	46	-	
Total Gate Charge	Q_g	$V_{CE} = 400\text{V}$,	-	84	-	nC
Gate - Emitter Charge	Q_{ge}	$I_C = 30\text{A}$,	-	17	-	
Gate - Collector Charge	Q_{gc}	$V_{GE} = 15\text{V}$	-	31	-	
Turn - on Delay Time	$t_{d(on)}$	$I_C = 15\text{A}$, $V_{CC} = 400\text{V}$, $V_{GE} = 15\text{V}$, $R_G = 10\Omega$, $T_j = 25^\circ\text{C}$ Inductive Load * E_{on} include diode reverse recovery	-	36	-	ns
Rise Time	t_r		-	9	-	
Turn - off Delay Time	$t_{d(off)}$		-	107	-	
Fall Time	t_f		-	55	-	
Turn - on Switching Loss	E_{on}	Inductive Load * E_{on} include diode reverse recovery	-	0.16	-	mJ
Turn - off Switching Loss	E_{off}		-	0.24	-	
Turn - on Delay Time	$t_{d(on)}$	$I_C = 15\text{A}$, $V_{CC} = 400\text{V}$, $V_{GE} = 15\text{V}$, $R_G = 10\Omega$, $T_j = 175^\circ\text{C}$ Inductive Load * E_{on} include diode reverse recovery	-	34	-	ns
Rise Time	t_r		-	10	-	
Turn - off Delay Time	$t_{d(off)}$		-	139	-	
Fall Time	t_f		-	76	-	
Turn - on Switching Loss	E_{on}	Inductive Load * E_{on} include diode reverse recovery	-	0.17	-	mJ
Turn - off Switching Loss	E_{off}		-	0.33	-	
Reverse Bias Safe Operating Area	RBSOA	$I_C = 120\text{A}$, $V_{CC} = 520\text{V}$, $V_P = 650\text{V}$, $V_{GE} = 15\text{V}$, $R_G = 100\Omega$, $T_j = 175^\circ\text{C}$	FULL SQUARE			-

●Electrical Characteristic Curves

Fig.1 Power Dissipation
vs. Case Temperature

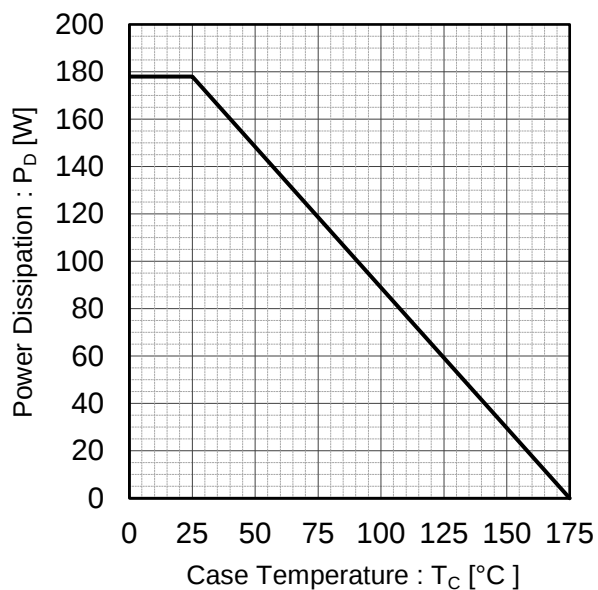


Fig.2 Collector Current
vs. Case Temperature

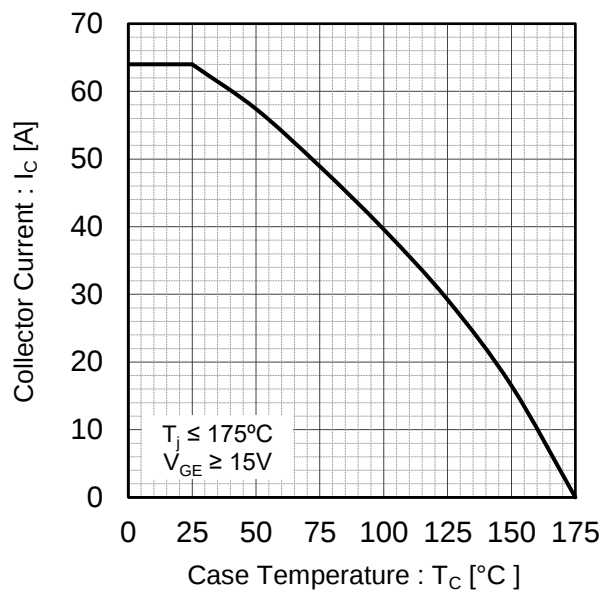


Fig.3 Forward Bias Safe Operating Area

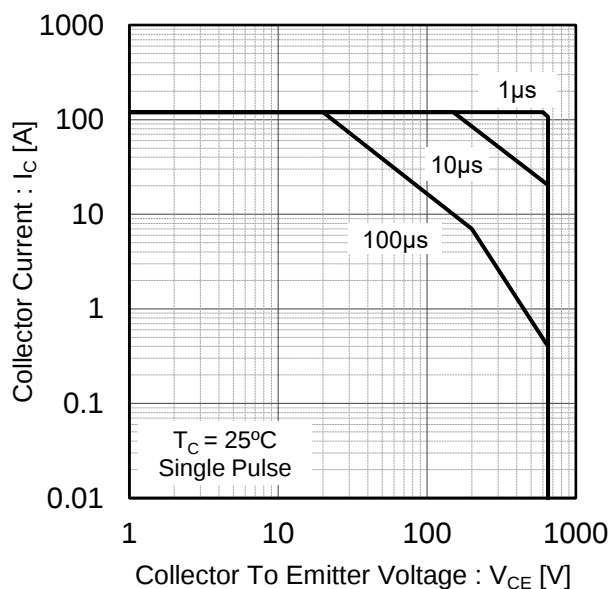
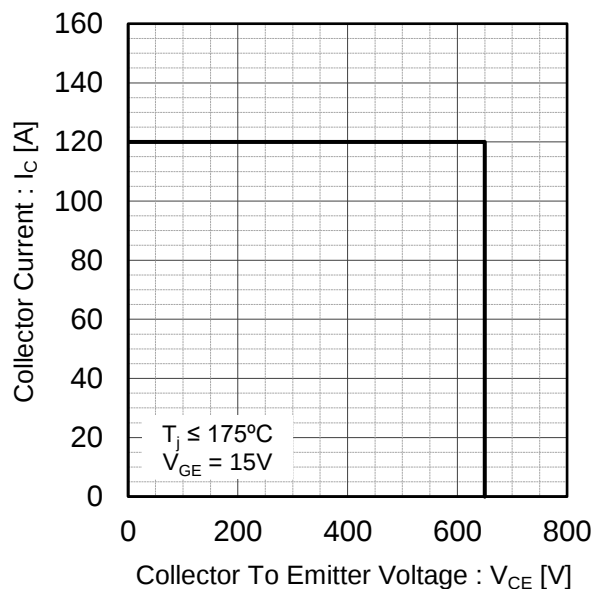


Fig.4 Reverse Bias Safe Operating Area



●Electrical Characteristic Curves

Fig.5 Typical Output Characteristics

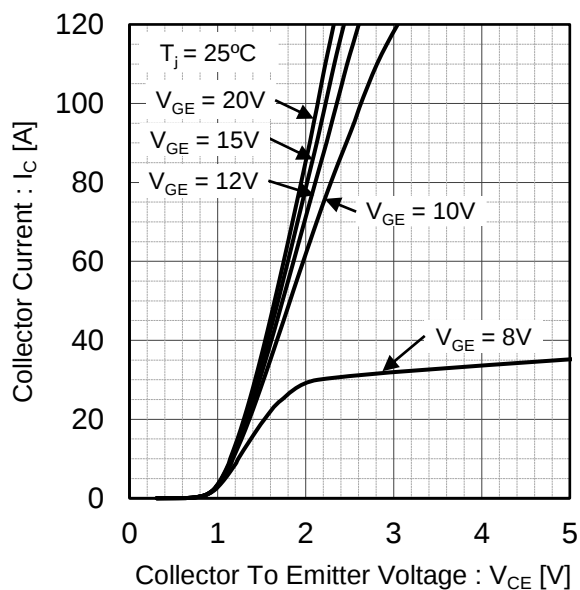


Fig.6 Typical Output Characteristics

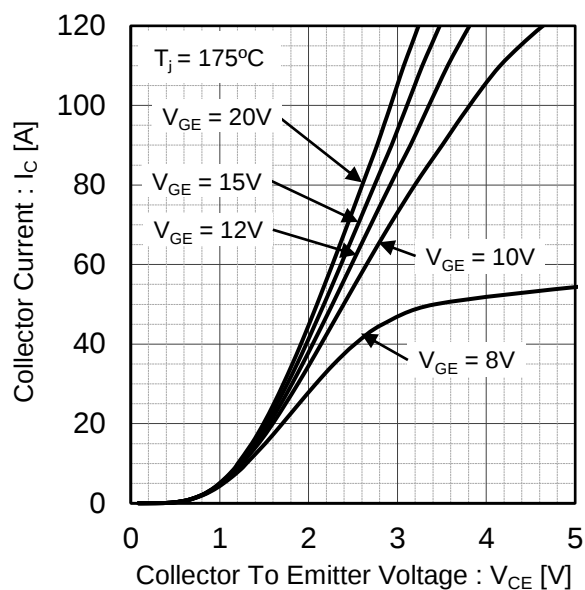


Fig.7 Typical Transfer Characteristics

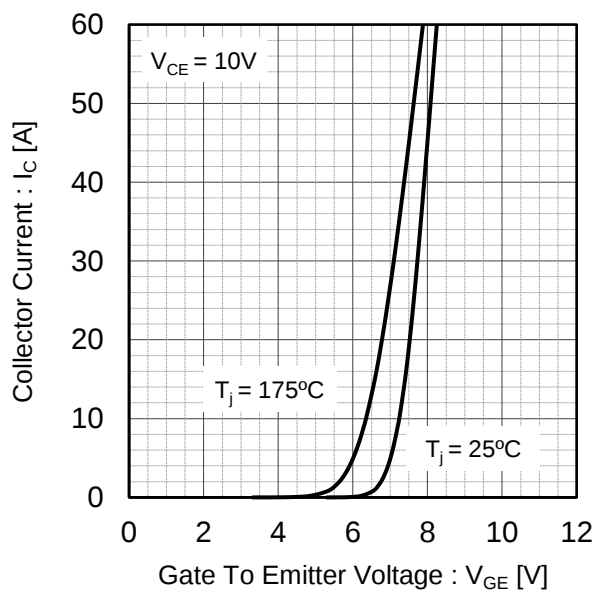
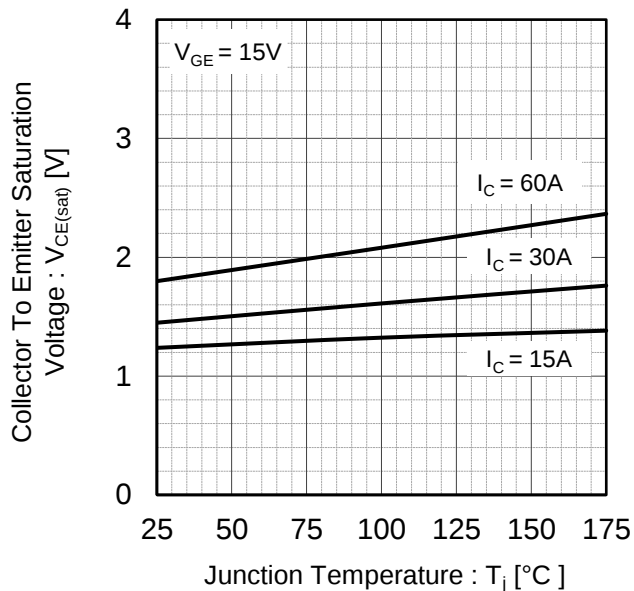


Fig.8 Typical Collector to Emitter Saturation Voltage vs. Junction Temperature



●Electrical Characteristic Curves

Fig.9 Typical Collector to Emitter Saturation Voltage vs. Gate to Emitter Voltage

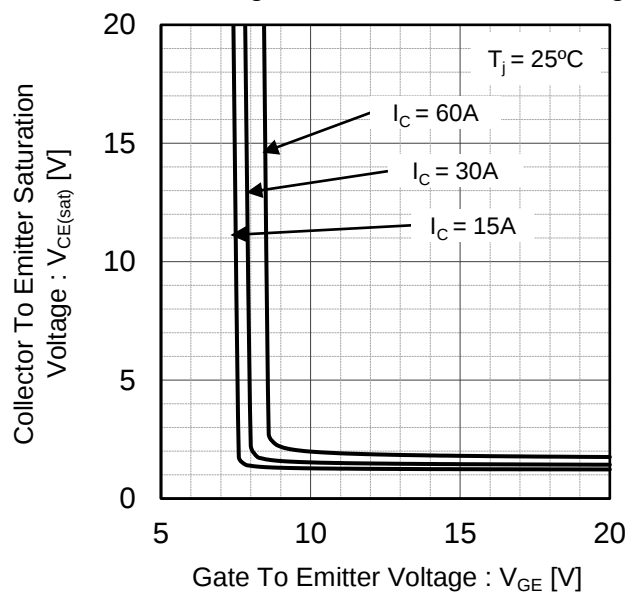


Fig.10 Typical Collector to Emitter Saturation Voltage vs. Gate to Emitter Voltage

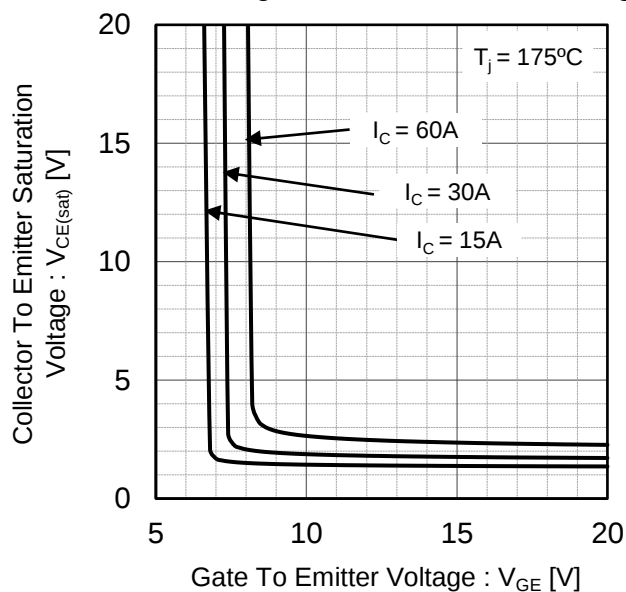


Fig.11 Typical Capacitance vs. Collector to Emitter Voltage

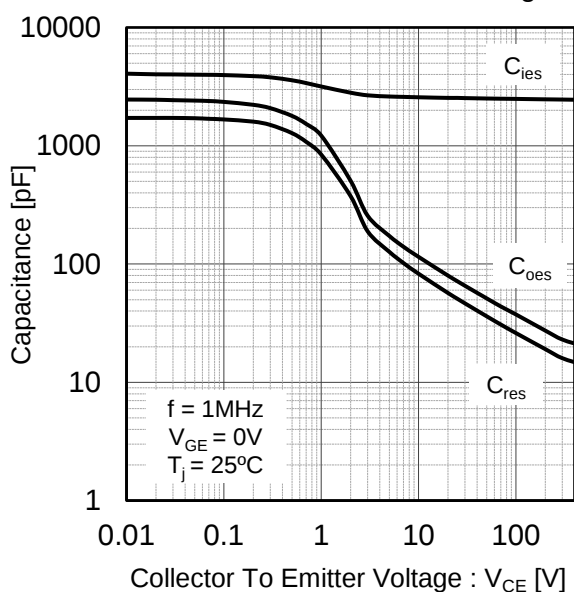
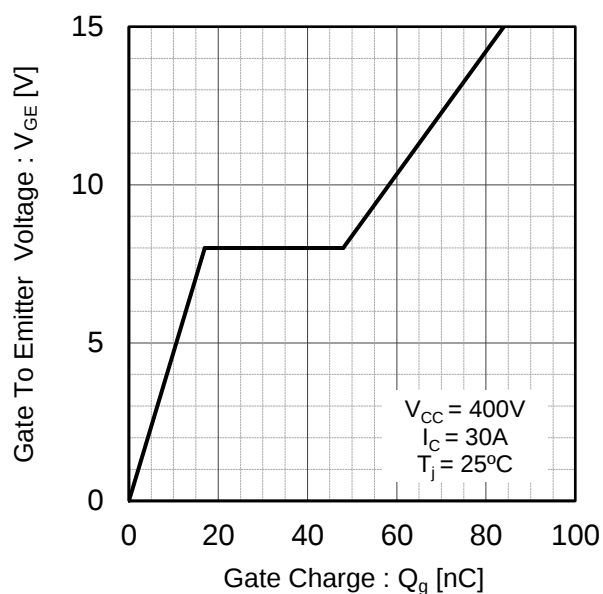


Fig.12 Typical Gate Charge



●Electrical Characteristic Curves

Fig.13 Typical Switching Time vs. Collector Current

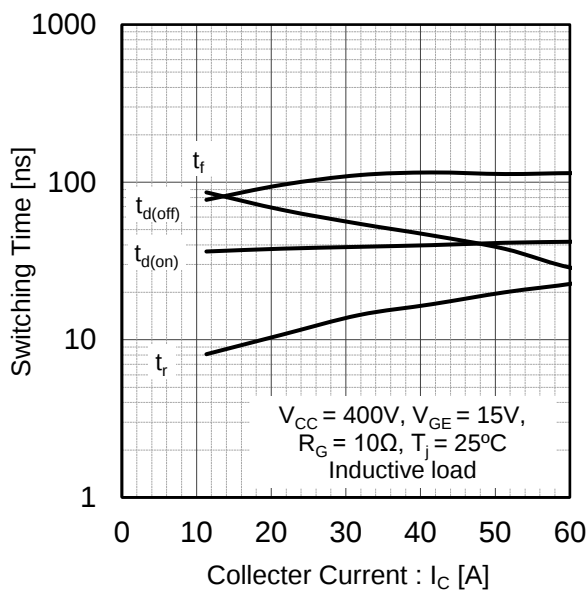


Fig.14 Typical Switching Time vs. Gate Resistance

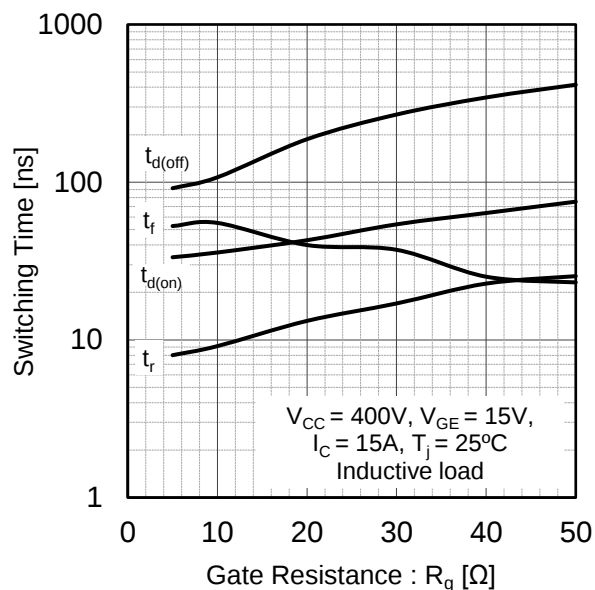


Fig.15 Typical Switching Energy Losses vs. Collector Current

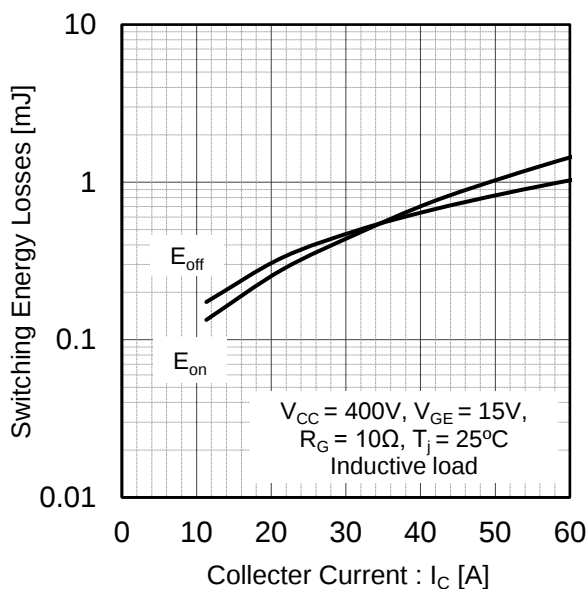
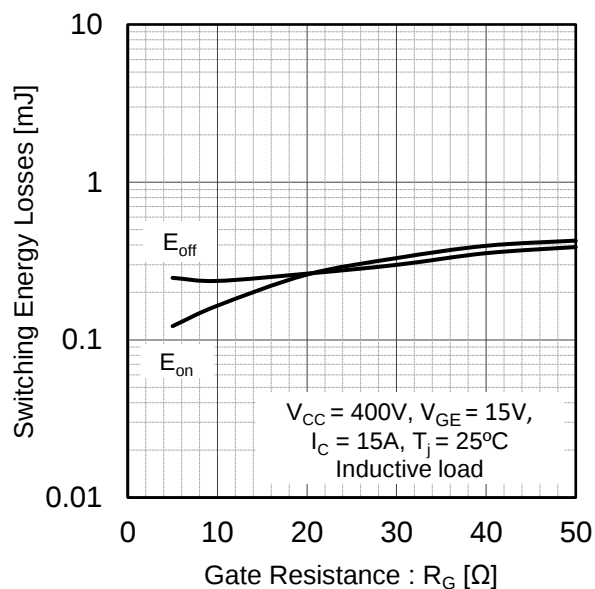


Fig.16 Typical Switching Energy Losses vs. Gate Resistance



●Electrical Characteristic Curves

Fig.17 Typical Switching Time vs. Collector Current

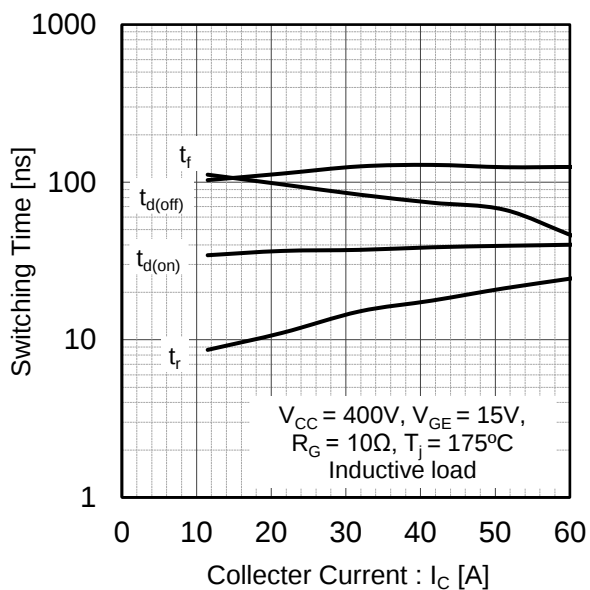


Fig.18 Typical Switching Time vs. Gate Resistance

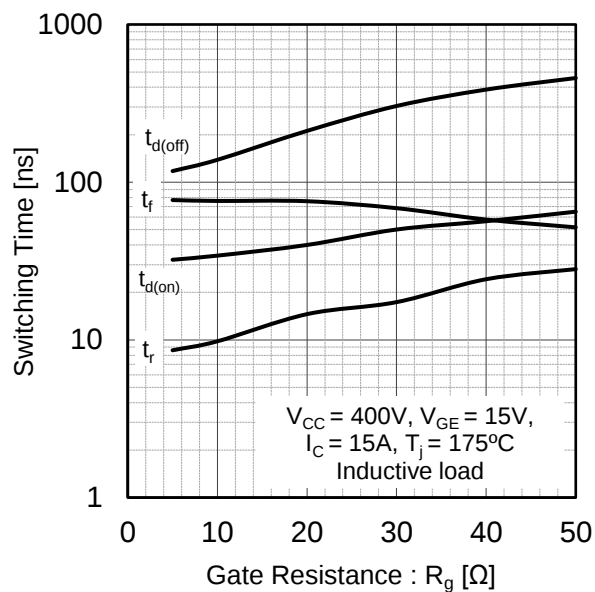


Fig.19 Typical Switching Energy Losses vs. Collector Current

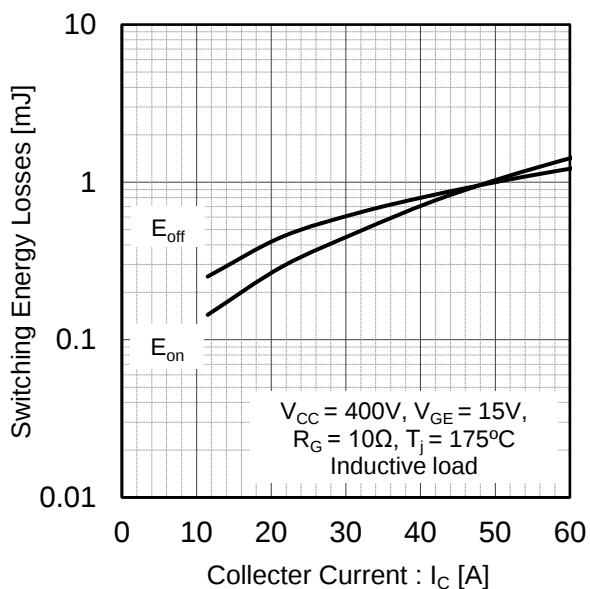
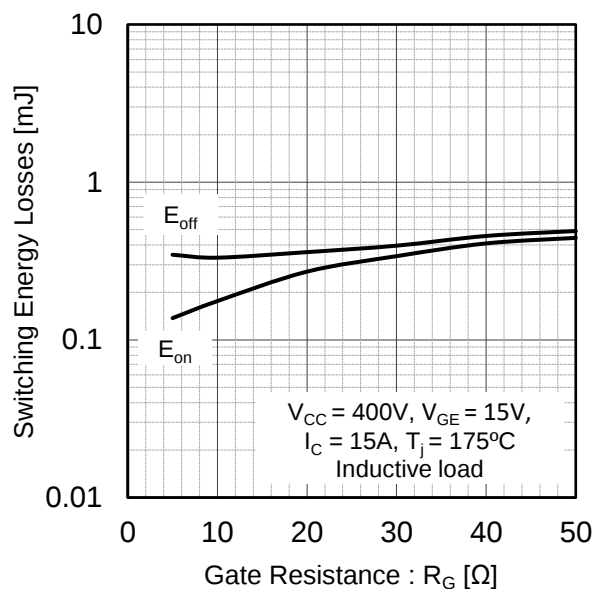
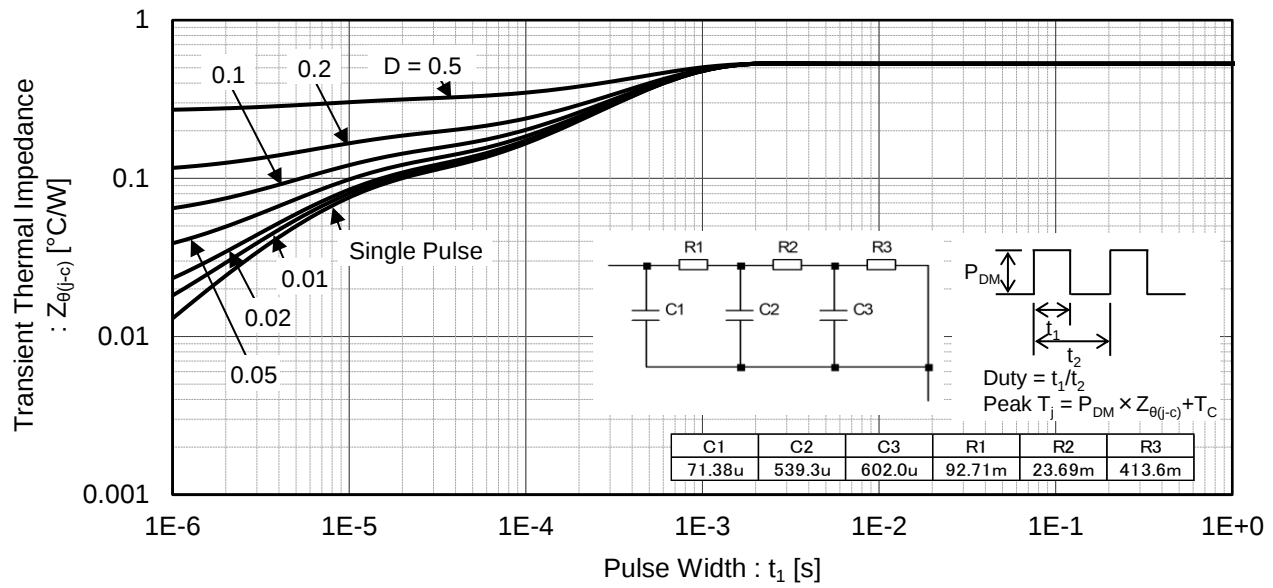


Fig.20 Typical Switching Energy Losses vs. Gate Resistance



●Electrical Characteristic Curves

Fig.21 Typical IGBT Transient Thermal Impedance



● Inductive Load Switching Circuit and Waveform

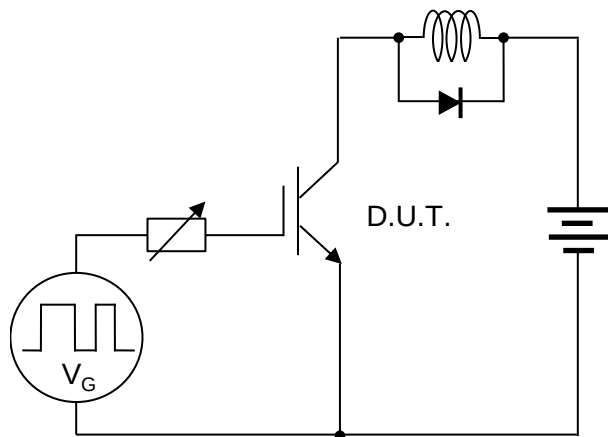


Fig.22 Inductive Load Circuit

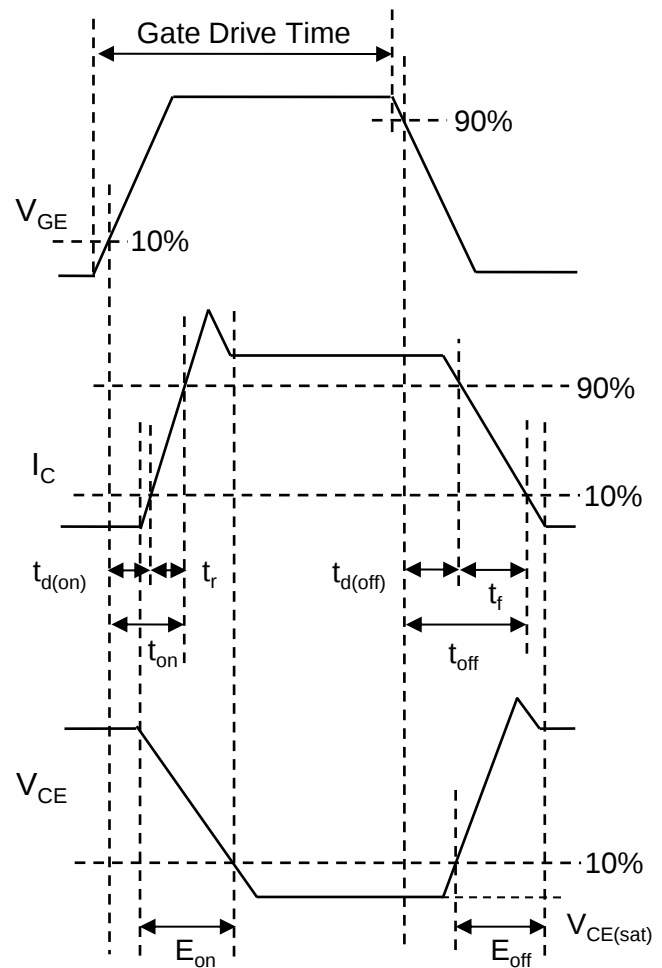


Fig.23 Inductive Load Waveform

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