RGS60NL65DHRBTL

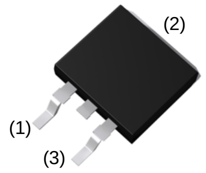
650V 30A Field Stop Trench IGBT

Datasheet

V_{CES}	650V
I_C	30A
$V_{CE(sat)}$ (Typ.)	1.65V
P_D	228W

●Outline

LPDL (TO-263L)



●Features

1) Qualified to AEC-Q101

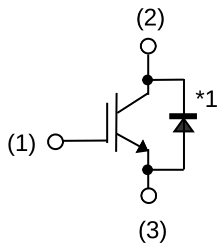
2) Low Collector - Emitter Saturation Voltage

3) Short Circuit Withstand Time 8μs

4) Built in Very Fast & Soft Recovery FRD

5) Pb - free Lead Plating ; RoHS Compliant

●Inner Circuit



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

*1 Built in FRD

●Application

General Inverter

for Automotive and Industrial Use

Heater for Automotive

●Packaging Specifications

Type	Packaging	Taping
	Reel Size (mm)	330
	Tape Width (mm)	24
	Basic Ordering Unit (pcs)	1,000
	Packing Code	TL
	Marking	RGS60NL65D

●Absolute Maximum Ratings (at T_C = 25°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°C	I_C	59	A
	T_C = 100°C	I_C	40	A
Pulsed Collector Current		I_{CP} *1	90	A
Diode Forward Current	T_C = 25°C	I_F	43	A
	T_C = 100°C	I_F	25	A
Diode Pulsed Forward Current		I_{FP} *1	90	A
Power Dissipation	T_C = 25°C	P_D	228	W
	T_C = 100°C	P_D	119	W
Operating Junction Temperature		T_j	-40 to +175	°C
Storage Temperature		T_{stg}	-55 to +175	°C

*1 Pulse width limited by $T_{jmax.}$

●Thermal Resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal Resistance IGBT Junction - Case	$R_{\theta(j-c)}$	-	-	0.63	°C/W
Thermal Resistance Diode Junction - Case	$R_{\theta(j-c)}$	-	-	1.55	°C/W

●IGBT Electrical Characteristics (at T_j = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Collector - Emitter Breakdown Voltage	BV_{CES}	I_C = 10μA, V_{GE} = 0V	650	-	-	V
Collector Cut - off Current	I_{CES}	V_{CE} = 650V, V_{GE} = 0V, T_j = 25°C Tj = 175°C	- -	- 0.1	10 -	μA mA
Gate - Emitter Leakage Current	I_{GES}	V_{GE} = ±30V, V_{CE} = 0V	-	-	±200	nA
Gate - Emitter Threshold Voltage	$V_{GE(th)}$	V_{CE} = 5V, I_C = 1.5mA	5.0	6.0	7.0	V
Collector - Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 30A, V_{GE} = 15V, T_j = 25°C T_j = 175°C	- -	1.65 2.15	2.10 -	V V

●**IGBT Electrical Characteristics** (at T_j = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input Capacitance	C_{ies}	V_{CE} = 30V, V_{GE} = 0V, f = 1MHz	-	980	-	pF
Output Capacitance	C_{oes}		-	80	-	
Reverse transfer Capacitance	C_{res}		-	13	-	
Total Gate Charge	Q_g	V_{CE} = 400V, I_C = 30A, V_{GE} = 15V	-	36	-	nC
Gate - Emitter Charge	Q_{ge}		-	10	-	
Gate - Collector Charge	Q_{gc}		-	15	-	
Turn - on Delay Time	$t_{d(on)}$	I_C = 30A, V_{CC} = 400V, V_{GE} = 15V, R_G = 10Ω, T_j = 25°C Inductive Load *E_{on} include diode reverse recovery	-	31	-	ns
Rise Time	t_r		-	13	-	
Turn - off Delay Time	$t_{d(off)}$		-	94	-	
Fall Time	t_f		-	91	-	
Turn - on Switching Loss	E_{on}		-	0.65	-	mJ
Turn - off Switching Loss	E_{off}		-	0.79	-	
Turn - on Delay Time	$t_{d(on)}$	I_C = 30A, V_{CC} = 400V, V_{GE} = 15V, R_G = 10Ω, T_j = 175°C Inductive Load *E_{on} include diode reverse recovery	-	31	-	ns
Rise Time	t_r		-	15	-	
Turn - off Delay Time	$t_{d(off)}$		-	111	-	
Fall Time	t_f		-	138	-	
Turn - on Switching Loss	E_{on}		-	0.73	-	mJ
Turn - off Switching Loss	E_{off}		-	1.03	-	
Reverse Bias Safe Operating Area	RBSOA	I_C = 90A, V_{CC} = 520V, V_P = 650V, V_{GE} = 15V, R_G = 50Ω, T_j = 175℃	FULL SQUARE			-
Short Circuit Withstand Time	t_{sc}	V_{CC} ≦ 360V, V_{GE} = 15V, T_j = 25°C	8	-	-	μs
Short Circuit Withstand Time	t_{sc} *2	V_{CC} ≦ 360V, V_{GE} = 15V, T_j = 150°C	6	-	-	μs

*2 Design assurance without measurement

●**FRD Electrical Characteristics** (at T_j = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Diode Forward Voltage	V_F	I_F = 25A, T_j = 25°C	-	1.5	1.95	V
		T_j = 175°C	-	1.6	-	
Diode Reverse Recovery Time	t_{rr}	I_F = 25A, V_{CC} = 400V, di_F/dt = 200A/μs, T_j = 25°C	-	95	-	ns
Diode Peak Reverse Recovery Current	I_{rr}		-	6.9	-	A
Diode Reverse Recovery Charge	Q_{rr}		-	0.37	-	μC
Diode Reverse Recovery Energy	E_{rr}		-	16	-	μJ
Diode Reverse Recovery Time	t_{rr}	I_F = 25A, V_{CC} = 400V, di_F/dt = 200A/μs, T_j = 175°C	-	127	-	ns
Diode Peak Reverse Recovery Current	I_{rr}		-	8.3	-	A
Diode Reverse Recovery Charge	Q_{rr}		-	0.64	-	μC
Diode Reverse Recovery Energy	E_{rr}		-	34	-	μJ

● Electrical Characteristic Curves

Fig.1 Power Dissipation vs. Case Temperature

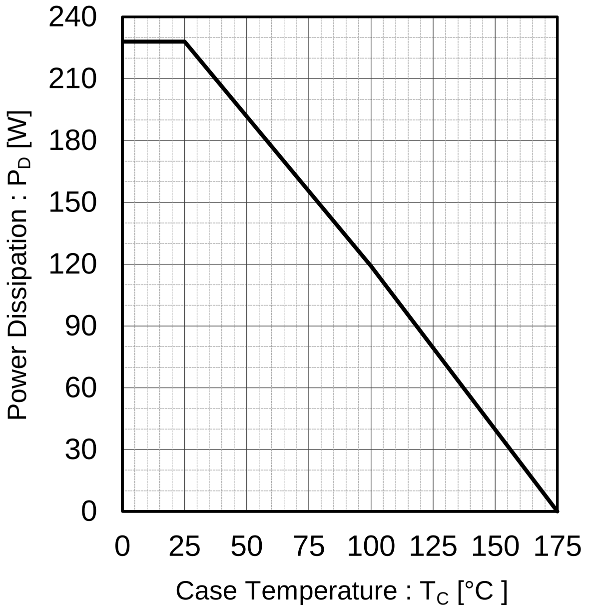


Fig.2 Collector Current vs. Case Temperature

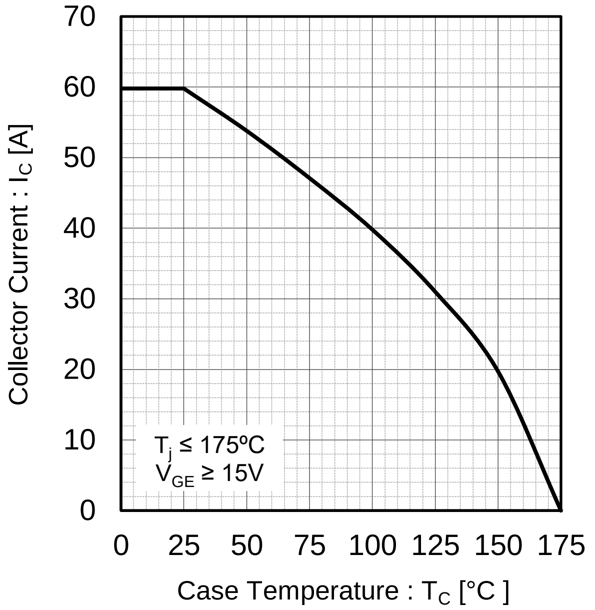


Fig.3 Forward Bias Safe Operating Area

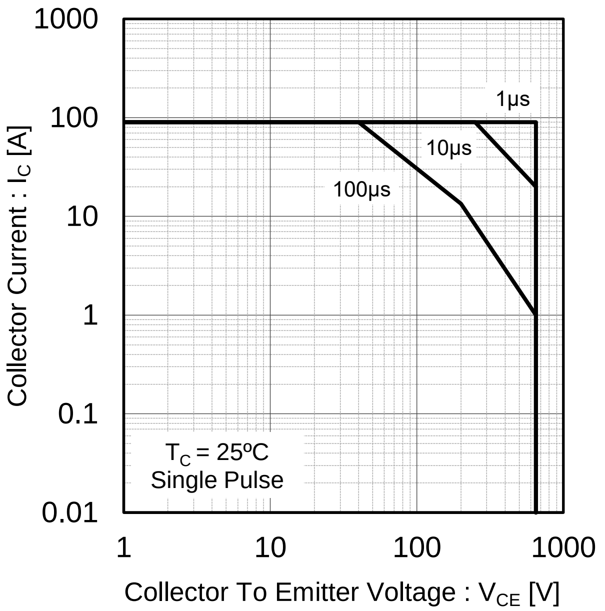
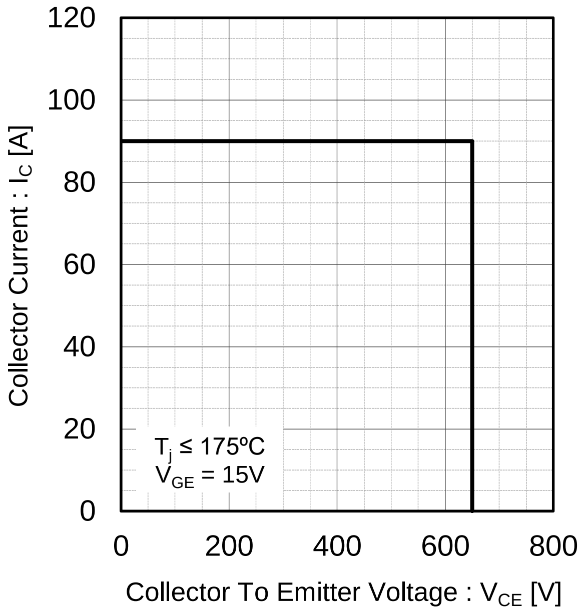


Fig.4 Reverse Bias Safe Operating Area



●Electrical Characteristic Curves

Fig.5 Typical Output Characteristics

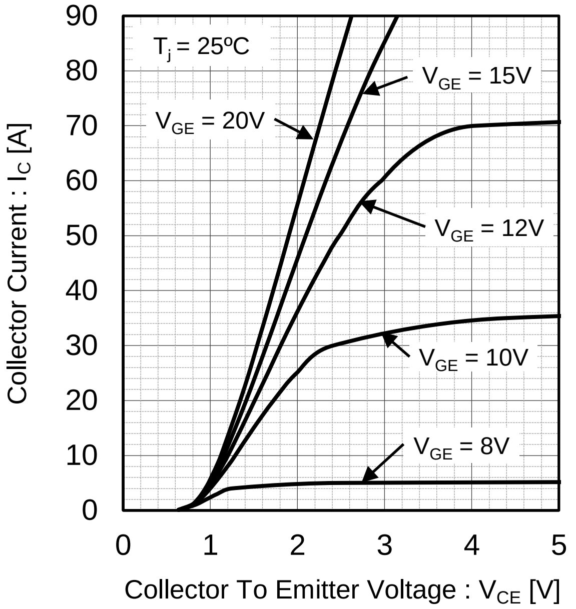


Fig.6 Typical Output Characteristics

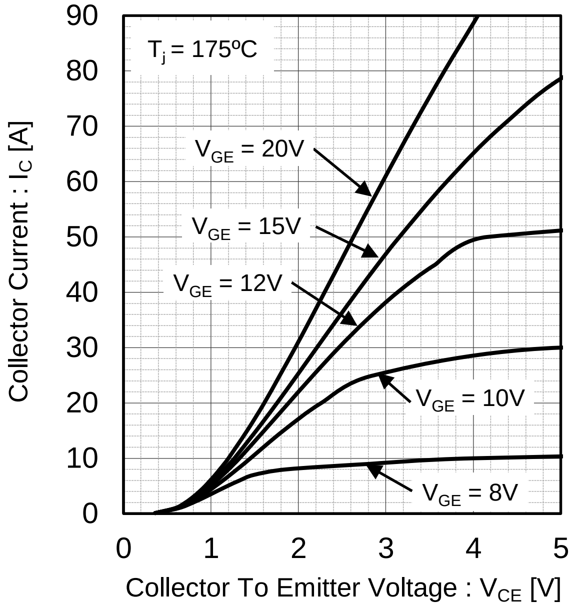


Fig.7 Typical Transfer Characteristics

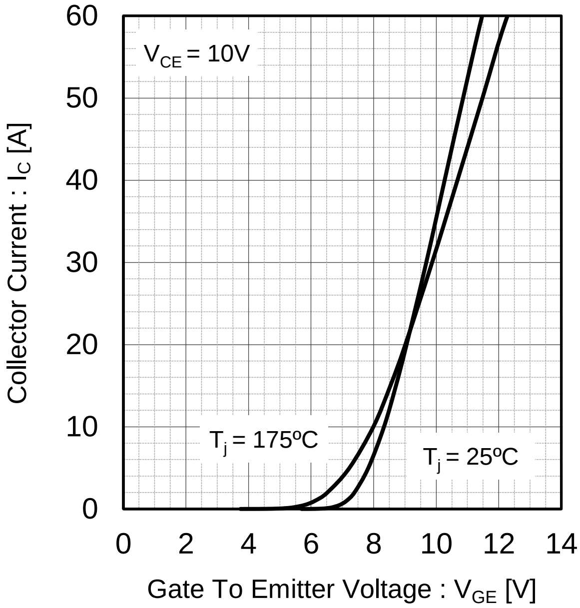
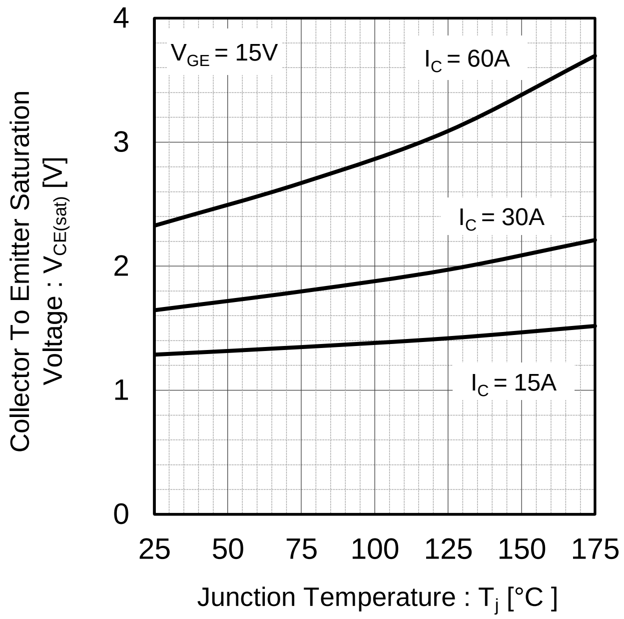


Fig.8 Typical Collector To Emitter Saturation Voltage vs. Junction Temperature



●Electrical Characteristic Curves

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

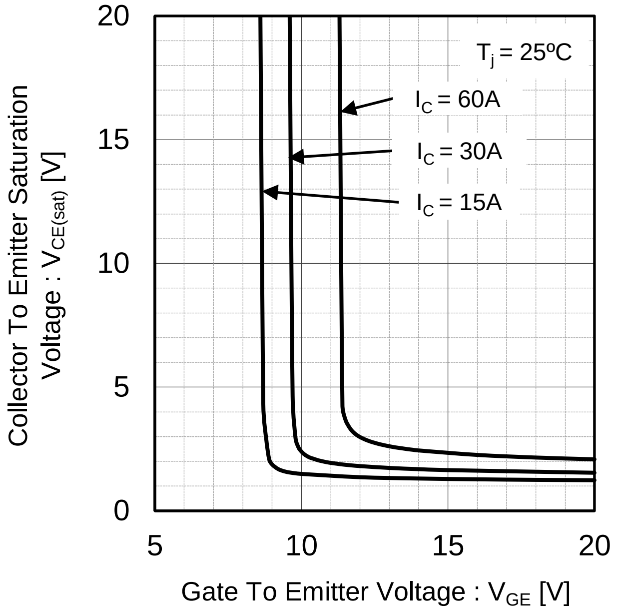


Fig.10 Typical Collector To Emitter Saturation Voltage vs. Gate To Emitter Voltage

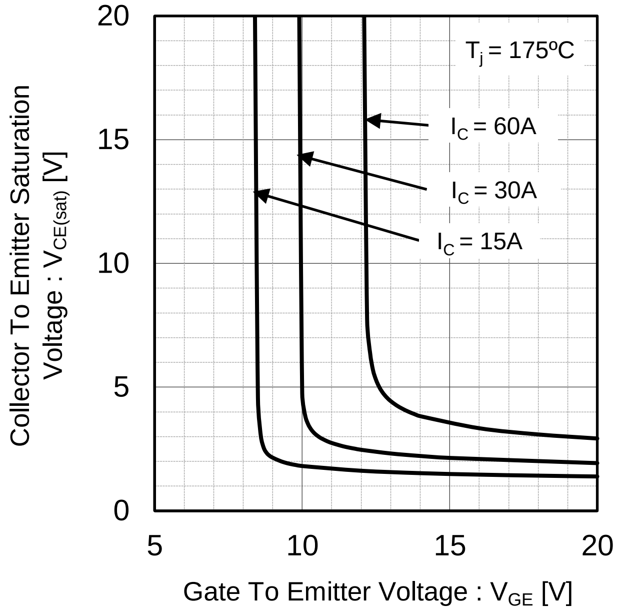


Fig.11 Typical Capacitance vs. Collector To Emitter Voltage

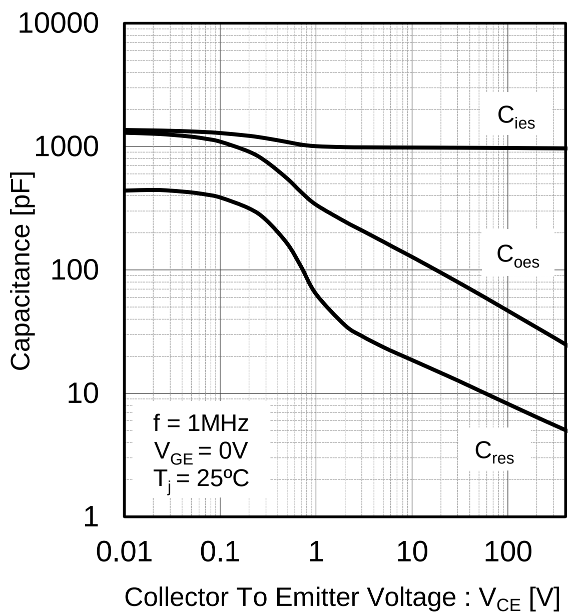
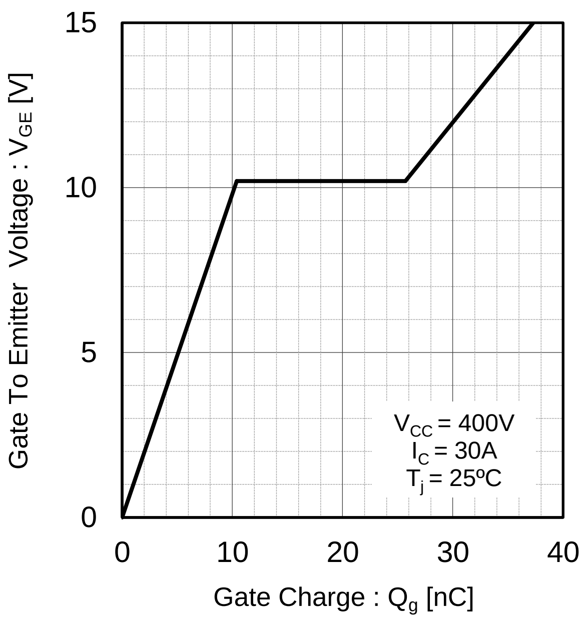


Fig.12 Typical Gate Charge



●Electrical Characteristic Curves

Fig.13 Typical Switching Time vs. Collector Current

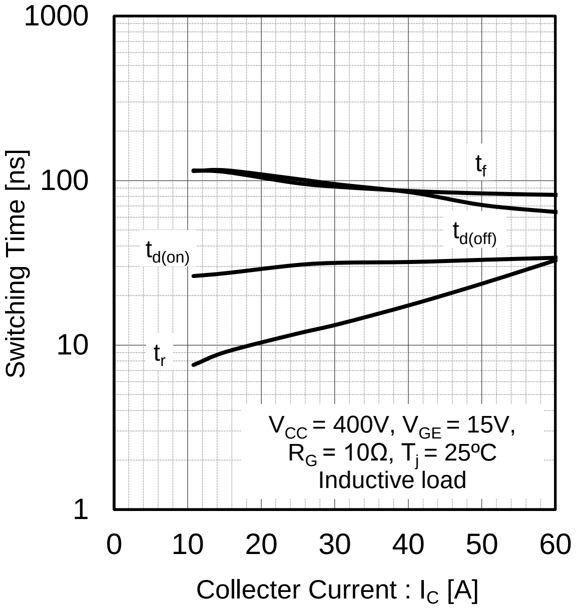


Fig.14 Typical Switching Time vs. Gate Resistance

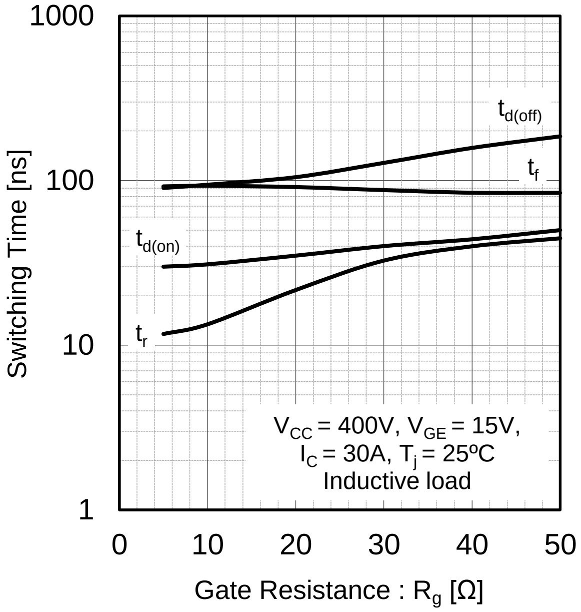


Fig.15 Typical Switching Energy Losses vs. Collector Current

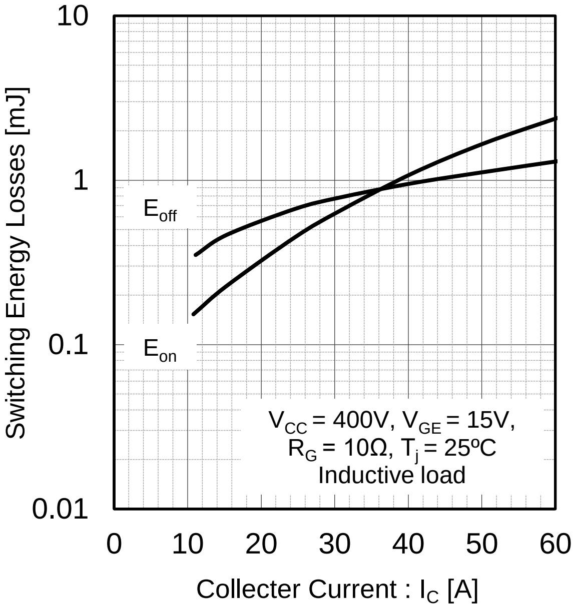
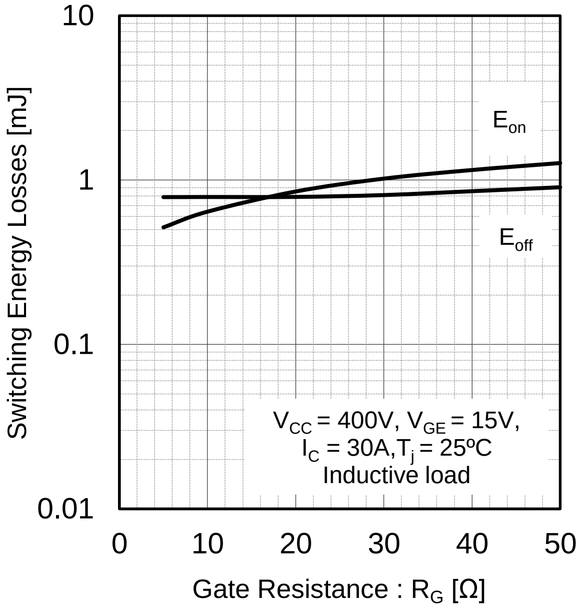


Fig.16 Typocal Switching Energy Losses vs. Gate Resistance



●Electrical Characteristic Curves

Fig.17 Typical Switching Time vs. Collector Current

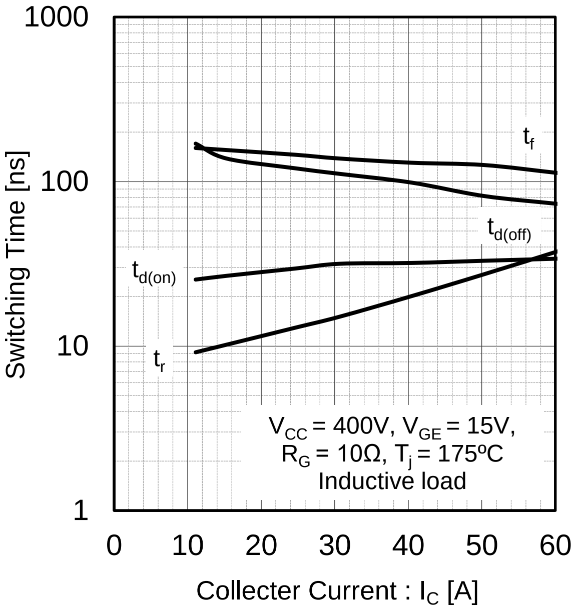


Fig.18 Typical Switching Time vs. Gate Resistance

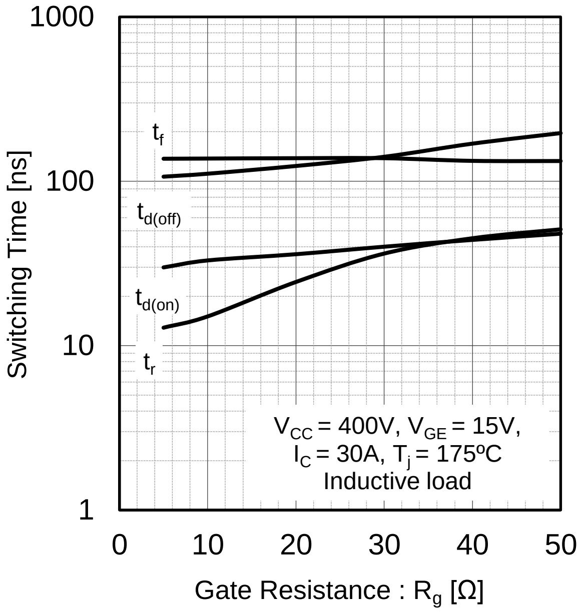


Fig.19 Typical Switching Energy Losses vs. Collector Current

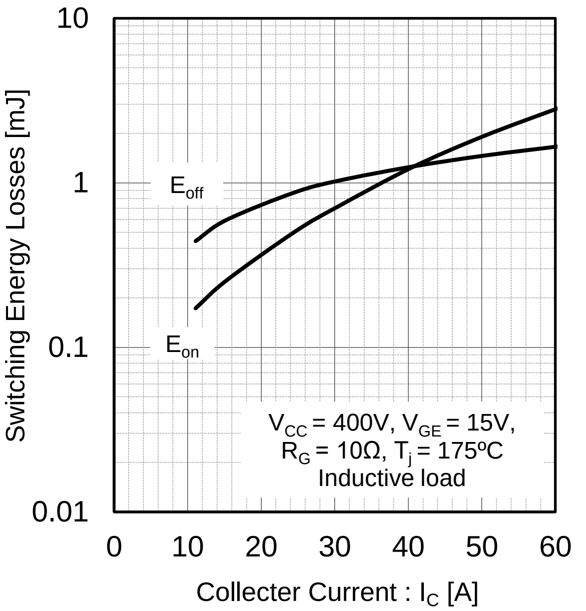
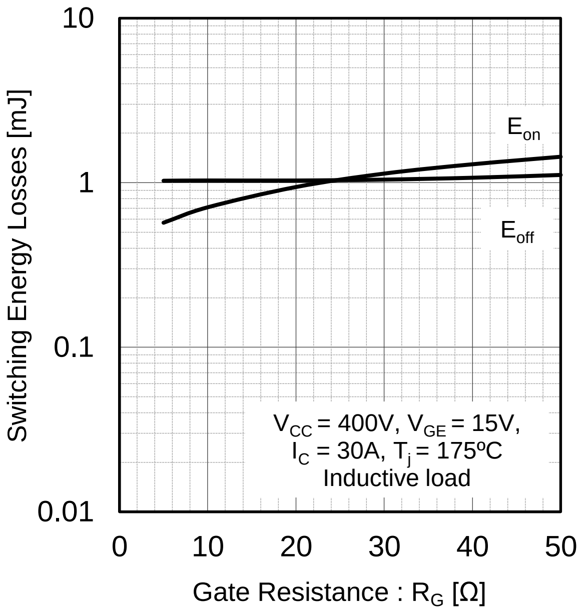


Fig.20 Typical Switching Energy Losses vs. Gate Resistance



●Electrical Characteristic Curves

Fig.21 Typical Diode Forward Current vs. Forward Voltage

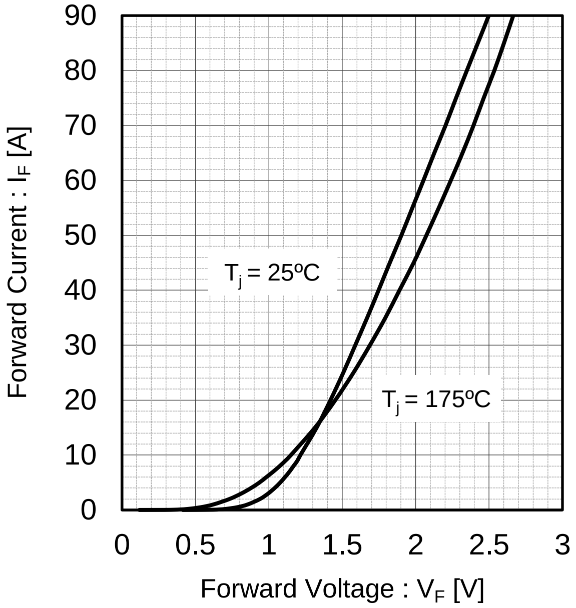


Fig.22 Typical Diode Revese Recovery Time vs. Forward Current

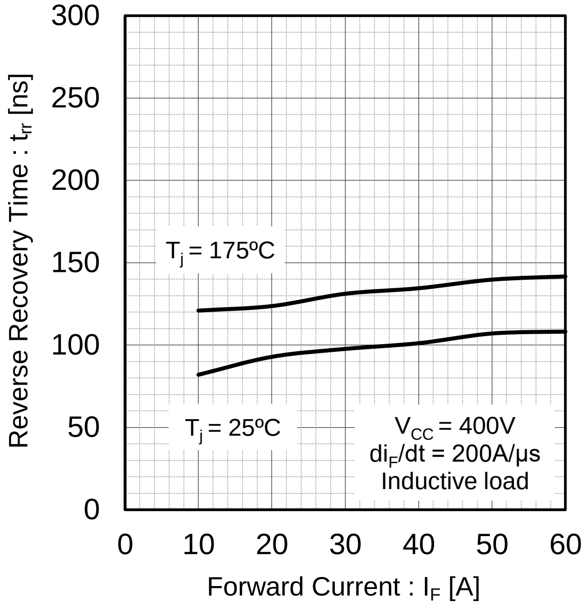


Fig.23 Typical Diode Reverse Recovery Current vs. Forward Current

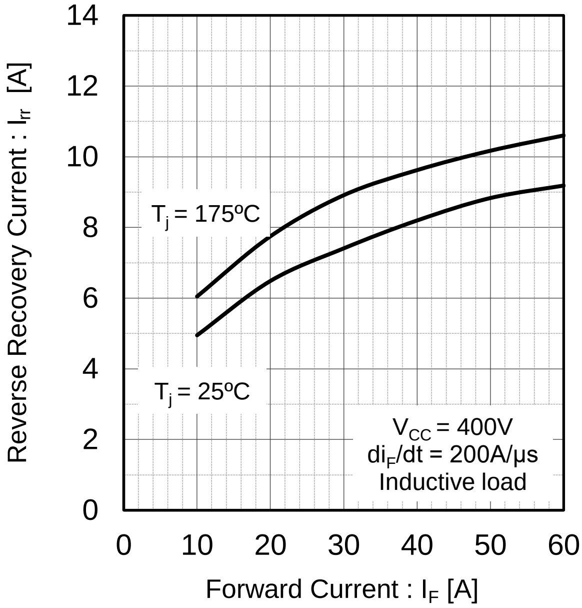
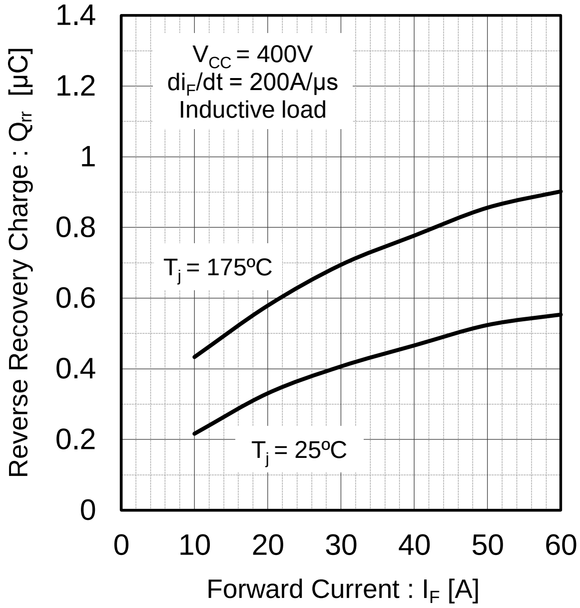


Fig.24 Typical Diode Rrverse Recovery Charge vs. Forward Current



●Electrical Characteristic Curves

Fig.25 Typical IGBT Transient Thermal Impedance

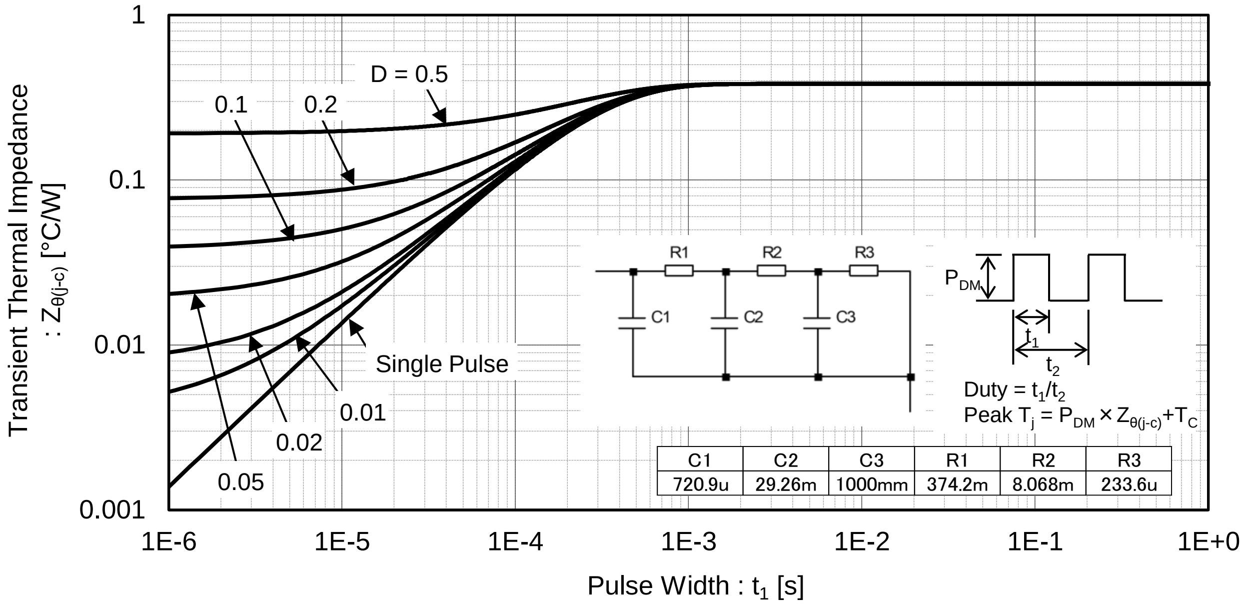
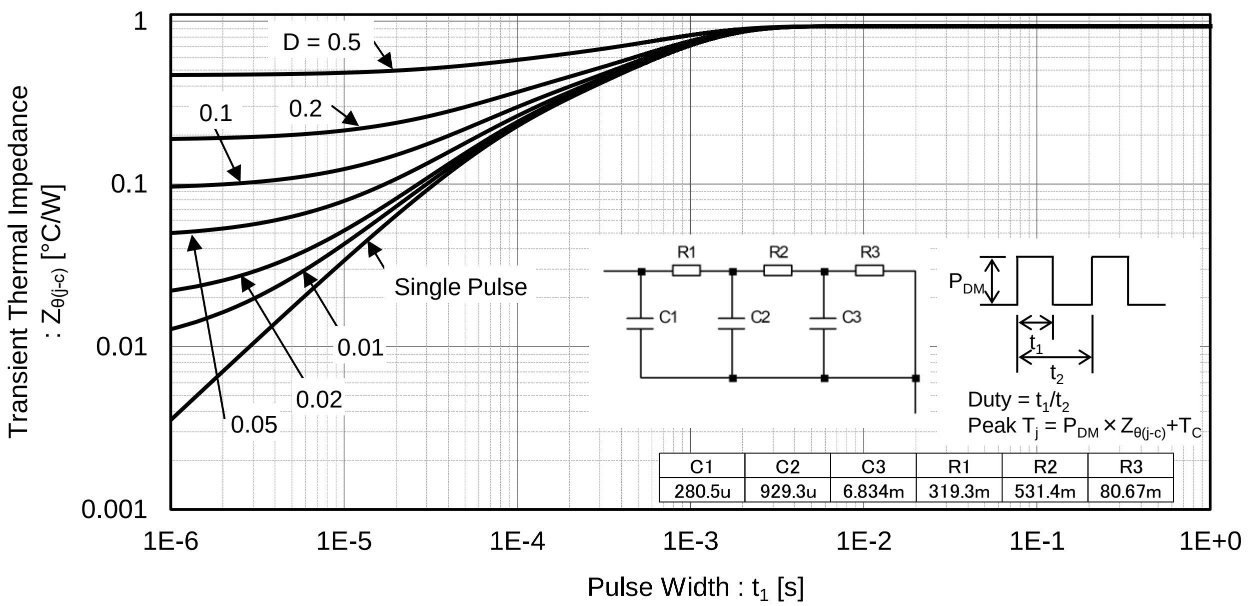


Fig.26 Typical Diode Transient Thermal Impedance



●Inductive Load Switching Circuit and Waveform

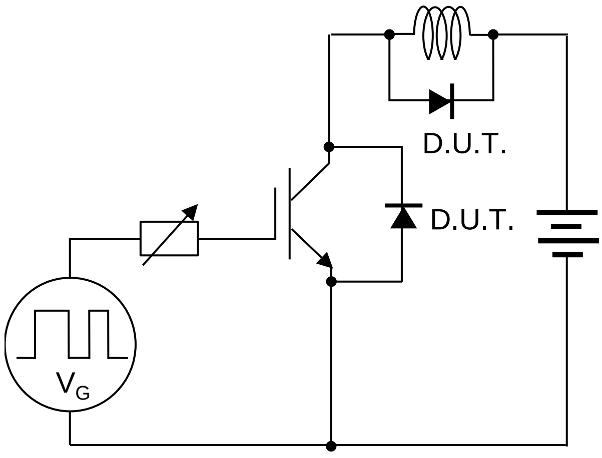
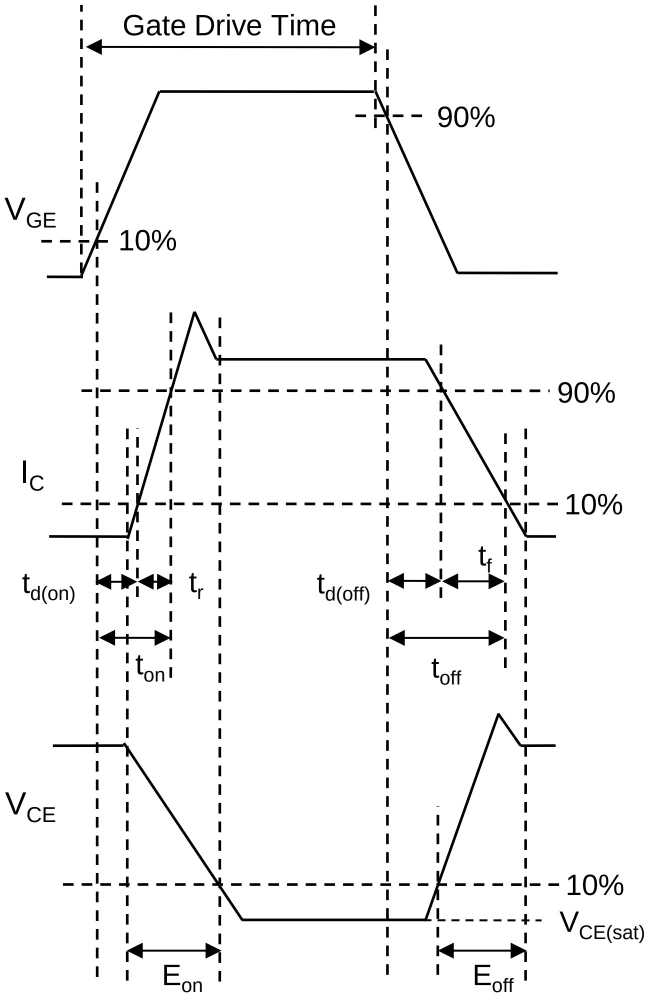


Fig.27 Inductive Load Circuit



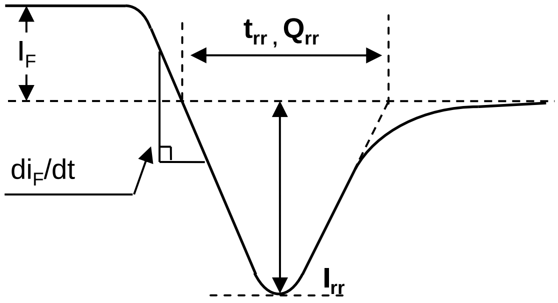


Fig.29 Diode Reverse Recovery Waveform

Fig.28 Inductive Load Waveform

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