CI15T60

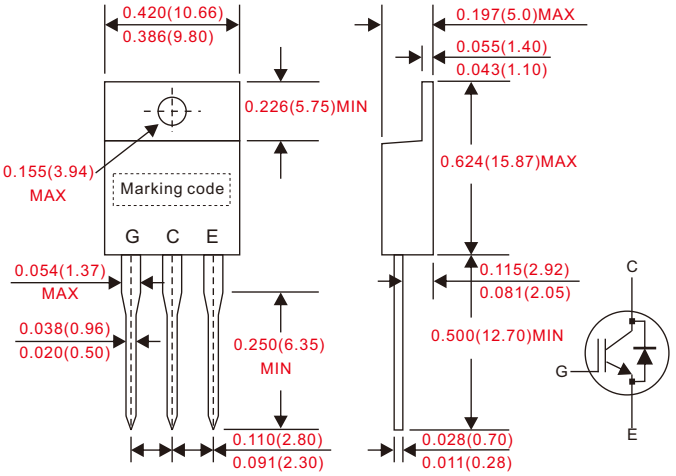
15A600V Field Stop Trench IGBT

■ Features

- Positive temperature Co-efficient for easy parallel operation.
- Short collector time-5us.
- High current capability.
- High input impedance.
- Low saturation voltage : $V_{CE(sat)}$ = 1.65@25°C.
- Fast switching : 20KHz ~ 40KHz(T_a = 25°C).
- Suffix "G" indicates Halogen-free part, ex.CI15T60G.

■ Outline

TO-220AB



Dimensions in inches and (millimeters)

■ Mechanical data

- Epoxy : UL94-V0 rated flame retardant.
- Case : JEDEC TO-220AB molded plastic body.
- Terminals : Solder plated, solderable per MIL-STD-750, Method 2026.
- Polarity: As marked.
- Mounting Position : Any.
- Weight : Approximated 2.25 gram.

■ Maximum ratings

Rating at 25°C ambient temperature unless otherwise specified. Single phase, half wave, 60Hz, resistive or inductive load. For capacitive load, derate current by 20%.

Parameter	Conditions	Symbol	CI15T60	UNIT
Marking code			CI15T60	
Collector to Emitter Voltage		V_{CE}	600	V
Collector Current	T_C = 25°C T_C = 100°C	I_C	30 15	A
Pulsed collector current		I_{Cpuls}	45*[2]	A
RBSOA current	V_{CE} < 600V, T_J < 150°C	I_{Cpeak}	45*	A
Diode Forward Current	T_C = 25°C T_C = 100°C	I_F	20 10	A
Pulsed doide current		I_{Fpuls}	30	A
Gate to Emitter Voltage		V_{GE}	±20	V
Short collector time[3]		t_{SC}	5	us
Power dissipation	T_C = 125°C T_C = 100°C	P_{tot}	125* 65*	W
Operating Junction Temperature		T_J	-55 ~ +150	°C
Storage Temperature Range		T_{STG}	-55 ~ +150	°C

Note : 1.Test Standard to follow JESD-022 .
2.Mark(*) is to estimate numerical value.
3.Test Cycle<1000 ； Test Timing>1s.

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■ Thermal characteristics

PARAMETER	CONDITIONS	Symbol	MIN.	TYP.	MAX.	UNIT
Thermal Resistance	Junction to Case	$R_{\theta JC}$		0.75	1	K/W
Diode thermal resistance	chip case	$R_{\theta JCD}$		1.4	1.9	
Thermal Resistance	Junction to Ambient	$R_{\theta JA}$			62	

■ Electrical characteristics(AT T_A=25°C unless otherwise noted)

On characteristivs

PARAMETER	CONDITIONS		Symbol	MIN.	TYP.	MAX.	UNIT
Collector to Emitter Breakdown Voltage	V_{GE} = 0V, I_C = 0.2mA		$V_{(BR)CES}$	600			V
Collector to Emitter Saturation Voltage	V_{GE} = 15V, I_C = 15A	T_J = 25°C	$V_{CE(sat)}$		1.65	1.9	
		T_J = 150°C			1.93		
Diode forward voltage	V_{GE} = 0V, I_F = 10A	T_J = 25°C	V_F		1.75		
		T_J = 150°C			1.40		
Gate threshold voltage	I_C = 0.21mA, V_{CE} = V_{GE}		$V_{GE(th)}$	4.4	5.25	6	
Collector Cut-Off Current	V_{CE} = 600V, V_{GE} = 0V	T_J = 25°C	I_{CES}			40	uA
		T_J = 150°C				1000	
G-E Leakage Current	V_{CE} = 0V, V_{GE} = 20V		I_{GES}			100	nA
Transconductance	V_{CE} = 20V, I_C = 15A		gFS		8.6		S

Dynamic characteristivs

PARAMETER	CONDITIONS	Symbol	MIN.	TYP.	MAX.	UNIT
Input Capacitance	V_{CE} = 25V	C_{iss}		1020		pF
Output Capacitance	V_{GE} = 0V	C_{oss}		74		
Reverse Transfer Capacitance	f = 1MHz	C_{rss}		35		
Total Gate Charge	V_{CC} = 480V, I_C = 15A, V_{GE} = 15V	Q_G		76		nC
Short Current	V_{CC} = 400V, V_{GE} = 15V	I_{SC}		120		A

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Switching characteristivs

PARAMETER	CONDITIONS	Symbol	MIN.	TYP.	MAX.	UNIT
Turn-On Delay Time	T_J = 25°C	$t_{d(on)}$		23		ns
Rise Time	V_{CC} = 400V, I_C = 15A	t_r		20		
Turn-Off Delay Time	V_{GE} = 15/0V	$t_{d(off)}$		139		
Fall Time	R_G = 15Ω	t_f		42		
Turn-On Switching Loss	L_{load} = 500μH	E_{on}		0.36		mJ
Turn-Off Switching Loss		E_{off}		0.32		
Total Switching Loss		E_{ts}		0.68		
Turn-On Delay Time	T_J = 150°C	$t_{d(on)}$		27		ns
Rise Time	V_{CC} = 400V, I_C = 15A	t_r		25		
Turn-Off Delay Time	V_{GE} = 15/0V	$t_{d(off)}$		155		
Fall Time	R_G = 15Ω	t_f		108		
Turn-On Switching Loss	L_{load} = 500μH	E_{on}		0.37		mJ
Turn-Off Switching Loss		E_{off}		0.46		
Total Switching Loss		E_{ts}		0.83		

Switching characteristivs

PARAMETER	CONDITIONS	Symbol	MIN.	TYP.	MAX.	UNIT
Reverse recovery time	T_J = 25°C	t_{rr}		45		ns
Reverse recovery charge	V_{CC} = 400V, I_F = 10A	Q_{rr}		73		nC
Repetitive Peak Reverse Current	diF/dt = 200A/μs	I_{rrm}		4		A
Reverse recovery time	T_J = 150°C	t_{rr}		92		ns
Reverse recovery charge	V_{CC} = 400V, I_F = 10A	Q_{rr}		371		nC
Repetitive Peak Reverse Current	diF/dt = 200A/μs	I_{rrm}		8		A

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■ Rating and characteristic curves

Fig 1.SAFE OPERATION AREA

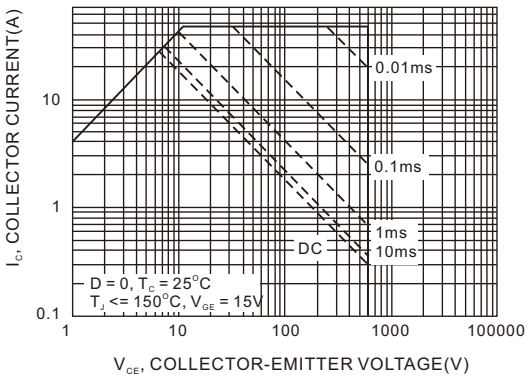

Fig 2.TYPICAL OUTPUT CHARACTERISTICS

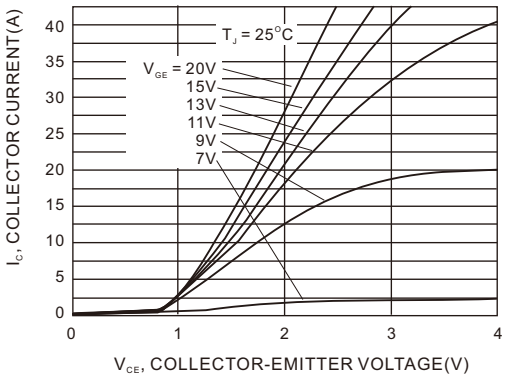

Fig 3.TYPICAL OUTPUT CHARACTERISTICS

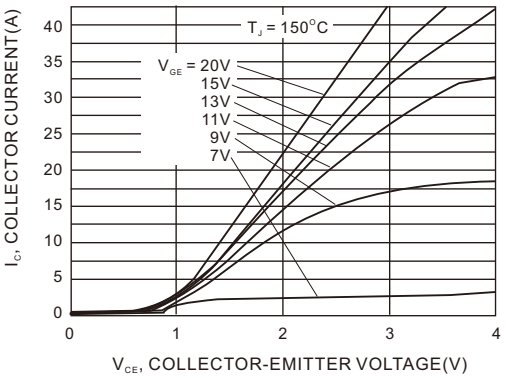

Fig 4.TYPICAL TRANSFER CHARACTERISTIC

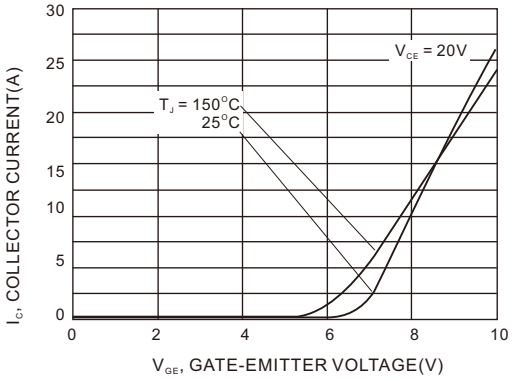

Fig 5.TYPICAL COLLECTOR-EMITTER SATURATION VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE

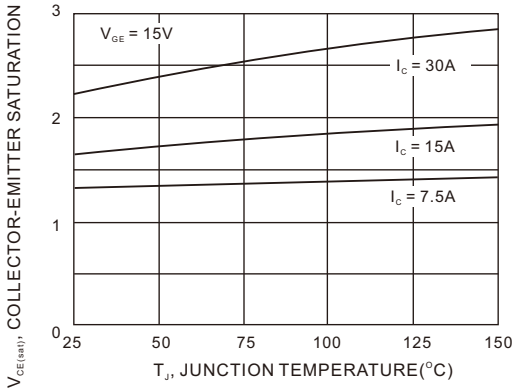

Fig 6.TYPICAL SWITCHING TIMES AS A FUNCTION OF COLLECTOR CURRENT

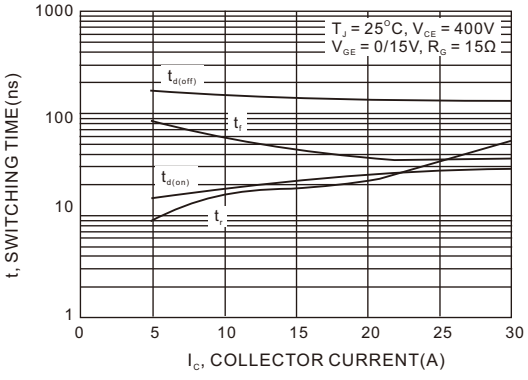

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Fig 7.TYPICAL SWITCHING TIMES AS A FUNCTION OF GATE RESISTOR

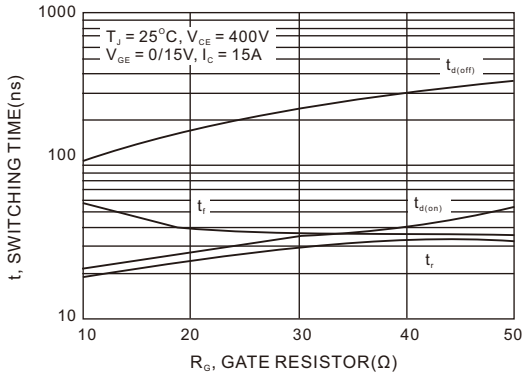

Fig 8.TYPICAL SWITCHING TIMES AS A FUNCTION OF JUNCTION TEMPERATURE

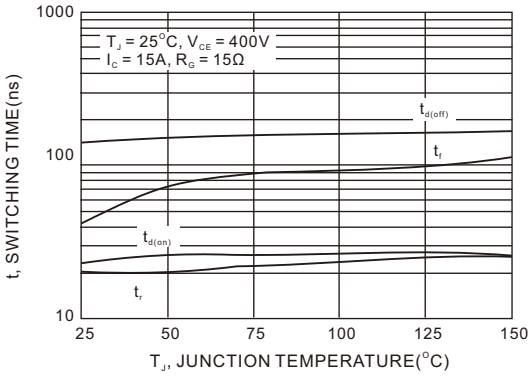

Fig 9.GATE-EMITTER THRESHOLDVOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE

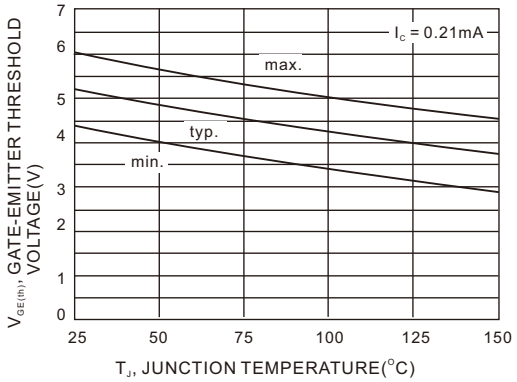

Fig 10.TYPICAL SWITCHING ENERGY LOSSES AS A FUNCTION OF COLLECTOR CURRENT

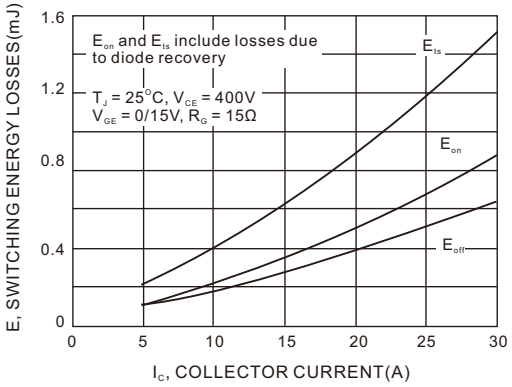

Fig 11.TYPICAL SWITCHING ENERGY LOSSES AS A FUNCTION OF GATE RESISTOR

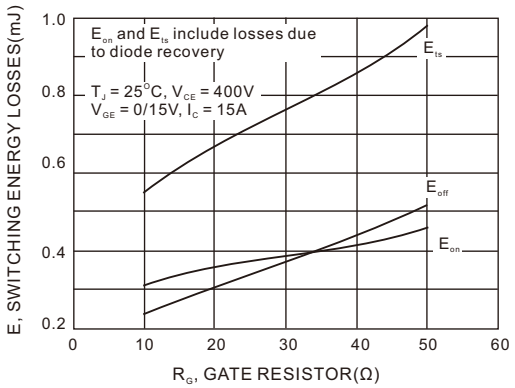

Fig 12.TYPICAL SWITCHING ENERGY LOSSES AS A FUNCTION OF COLLECTOR-EMITTER VOLTAGE

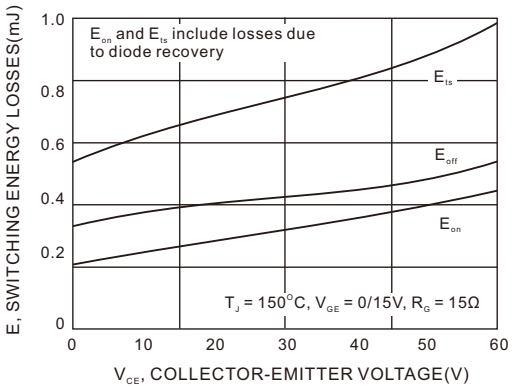

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Fig 13.TYPICAL GATE CHARGE

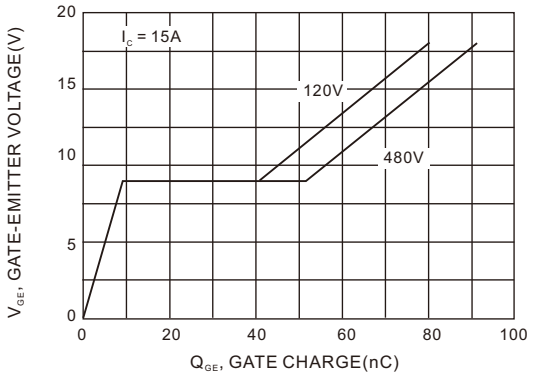

Fig 14.TYPICAL CAPACITANCE AS A FUNCTION OF COLLECTOR-EMITTER VOLTAGE

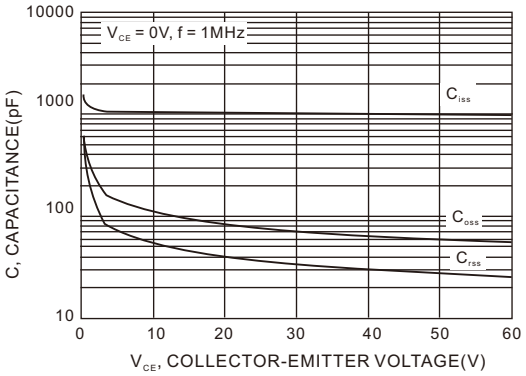

Fig 15.TYPICAL SHORT CIRCUIT COLLECTOR AS A FUNCTION OF GATE-EMITTER VOLTAGE

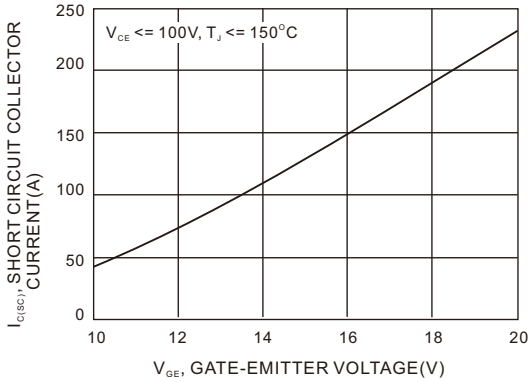

Fig 16.IGBT TRANSIENT THERMAL RESISTANCE

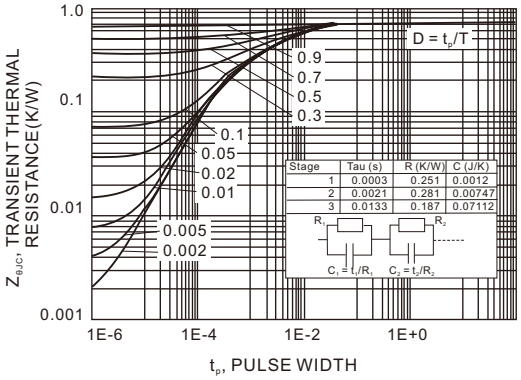

Fig 17.DIODE TRANSIENT THERMAL RESISTANCE

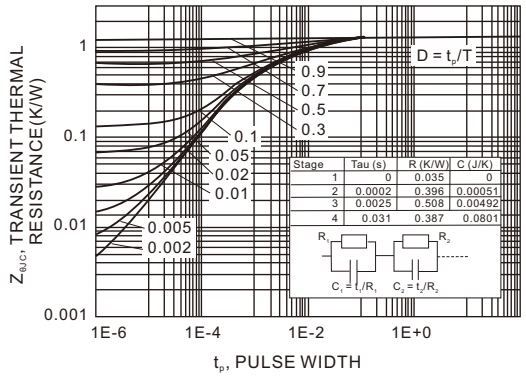

Fig 18.TYPICAL REVERSE RECOVERY TIME AS A FUNCTION OF DIODE CURRENT SLOPE

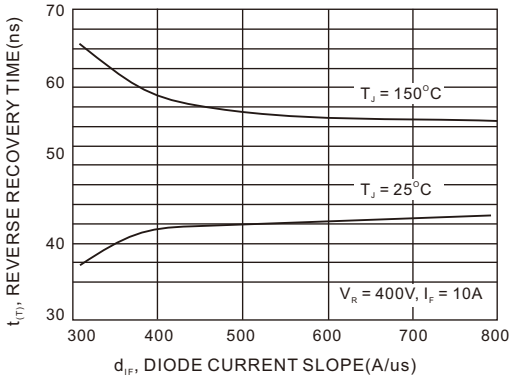

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Fig 19.TYPICAL REVERSE RECOVERY CHARGE AS A FUNCTION OF DIODE CURRENT SLOPE

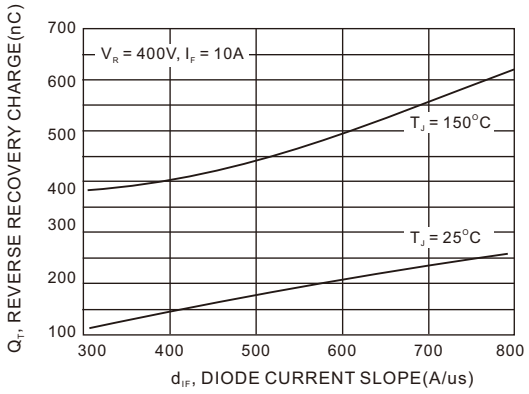

Fig 20.TYPICAL REVERSE RECOVERY CURRENT AS A FUNCTION OF DIODE CURRENT SLOPE

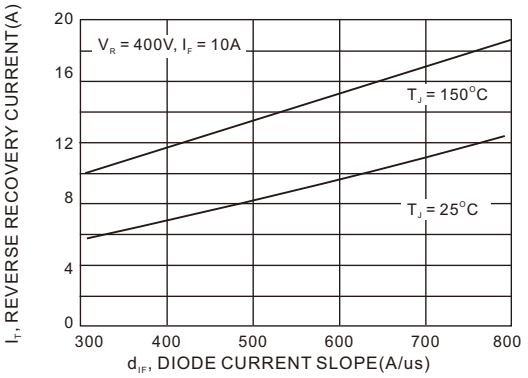

Fig 21.TYPICAL DIODE PEAK RATE OF FALL OF REVERSE RECOVERY CURRENT AS A FUNCTION OF DIODE CURRENT SLOPE

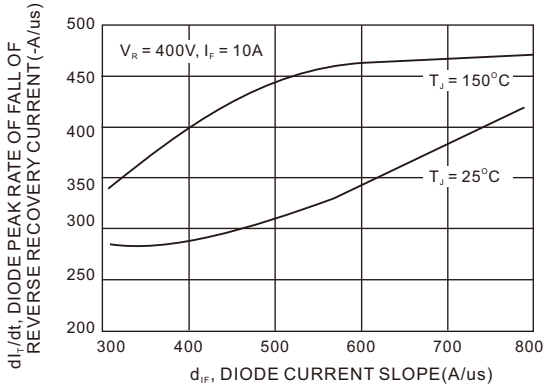

Fig 22.TYPICAL DIODE FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE

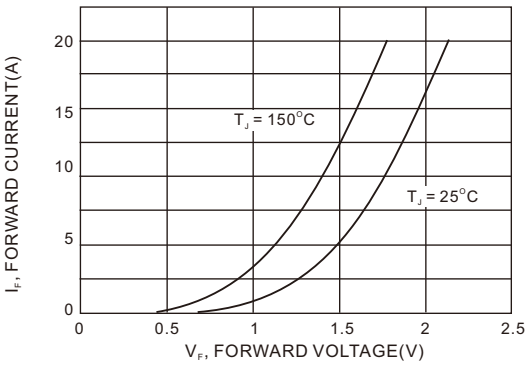

Fig 23.TYPICAL DIODE FORWARD VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE

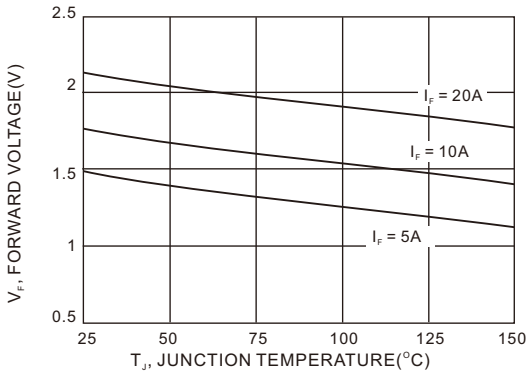

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Fig A.DYNAMIC TEST CIRCUIT

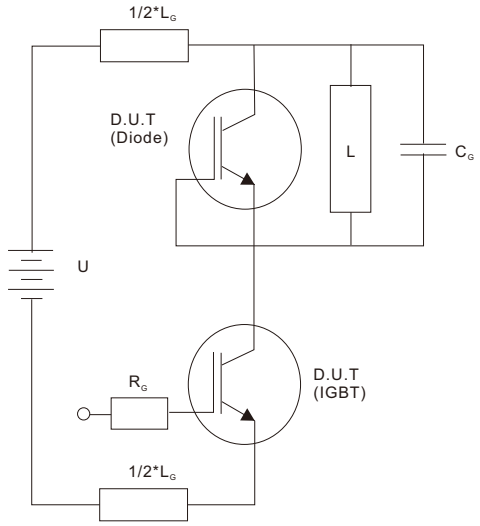


Fig B.DEFINITION OF SWITCHING LOSSES

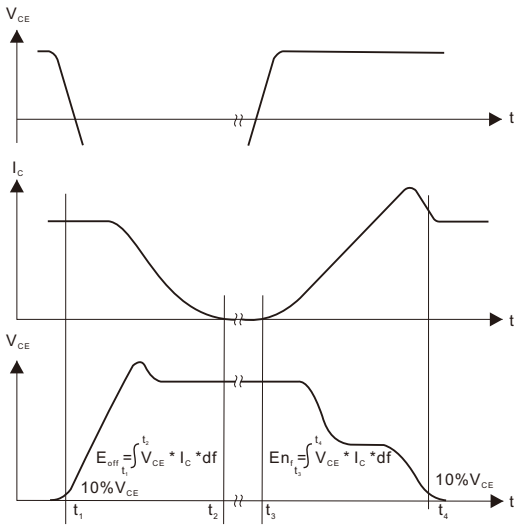


Fig C.DEFINITION OF DIODES
SWITCHING CHARACTERISTICS

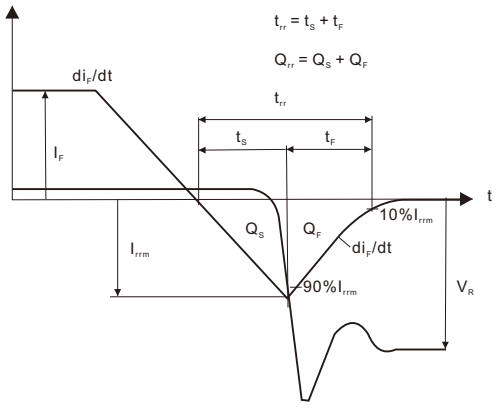
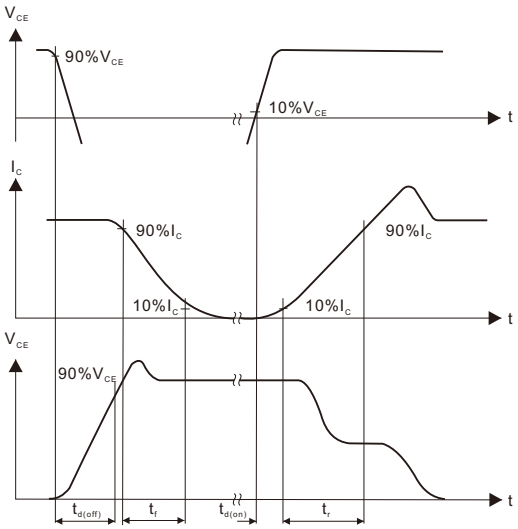


Fig D.DEFINITION OF SWITCHING TIMES



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