

■ Features

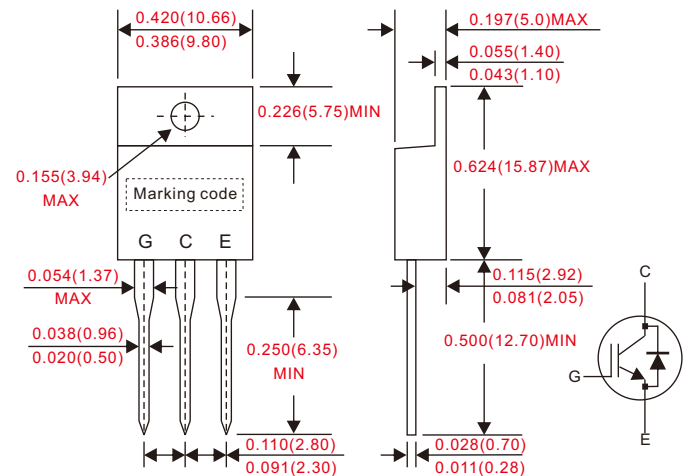
- Positive temperature Co-efficient for easy parallel operation.
- Short collector time-5us.
- High current capability.
- High input impedance.
- Low saturation voltage : $V_{CE(sat)} = 1.65@25^{\circ}C$.
- Fast switching : 20KHz ~ 40KHz($T_a = 25^{\circ}C$).
- Suffix "G" indicates Halogen-free part,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

■ 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.

■ Outline

TO-220AB



■ 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	$T_c = 25^{\circ}C$ $T_c = 100^{\circ}C$	I_C	30 15	A
Pulsed collector current		I_{Cpuls}	45 ^{*2}	A
RBSOA current	$V_{CE} < 600V, T_J < 150^{\circ}C$	I_{Cpeak}	45 [*]	A
Diode Forward Current	$T_c = 25^{\circ}C$ $T_c = 100^{\circ}C$	I_F	20 10	A
Pulsed diode current		I_{Fpuls}	30	A
Gate to Emitter Voltage		V_{GE}	±20	V
Short collector time ³		t_{SC}	5	us
Power dissipation	$T_c = 125^{\circ}C$ $T_c = 100^{\circ}C$	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.

■ 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 $T_A=25^{\circ}\text{C}$ unless otherwise noted)

On characteristics

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	$V_{GE} = 15V, I_C = 15A$ $T_J = 25^{\circ}\text{C}$ $T_J = 150^{\circ}\text{C}$	$V_{CE(sat)}$		1.65 1.93	1.9	
Diode forward voltage	$V_{GE} = 0V, I_F = 10A$ $T_J = 25^{\circ}\text{C}$ $T_J = 150^{\circ}\text{C}$	V_F		1.75 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	$V_{CE} = 600V, V_{GE} = 0V$ $T_J = 25^{\circ}\text{C}$ $T_J = 150^{\circ}\text{C}$	I_{CES}			40 1000	μA
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 characteristics

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

Switching characteristics						
PARAMETER	CONDITIONS	Symbol	MIN.	TYP.	MAX.	UNIT
Turn-On Delay Time	$T_J = 25^{\circ}\text{C}$ $V_{CC} = 400\text{V}, I_C = 15\text{A}$ $V_{GE} = 15/0\text{V}$ $R_G = 15\Omega$ $L_{load} = 500\mu\text{H}$	$t_{d(on)}$		23		ns
Rise Time		t_r		20		
Turn-Off Delay Time		$t_{d(off)}$		139		
Fall Time		t_f		42		
Turn-On Switching Loss	$L_{load} = 500\mu\text{H}$	E_{on}		0.36		mJ
Turn-Off Switching Loss		E_{off}		0.32		
Total Switching Loss		E_{ts}		0.68		
Turn-On Delay Time	$T_J = 150^{\circ}\text{C}$ $V_{CC} = 400\text{V}, I_C = 15\text{A}$ $V_{GE} = 15/0\text{V}$ $R_G = 15\Omega$ $L_{load} = 500\mu\text{H}$	$t_{d(on)}$		27		ns
Rise Time		t_r		25		
Turn-Off Delay Time		$t_{d(off)}$		155		
Fall Time		t_f		108		
Turn-On Switching Loss	$L_{load} = 500\mu\text{H}$	E_{on}		0.37		mJ
Turn-Off Switching Loss		E_{off}		0.46		
Total Switching Loss		E_{ts}		0.83		
Switching characteristics						
PARAMETER	CONDITIONS	Symbol	MIN.	TYP.	MAX.	UNIT
Reverse recovery time	$T_J = 25^{\circ}\text{C}$ $V_{CC} = 400\text{V}, I_F = 10\text{A}$ $diF/dt = 200\text{A}/\mu\text{s}$	t_{rr}		45		ns
Reverse recovery charge		Q_{rr}		73		nC
Repetitive Peak Reverse Current		I_{rrm}		4		A
Reverse recovery time	$T_J = 150^{\circ}\text{C}$ $V_{CC} = 400\text{V}, I_F = 10\text{A}$ $diF/dt = 200\text{A}/\mu\text{s}$	t_{rr}		92		ns
Reverse recovery charge		Q_{rr}		371		nC
Repetitive Peak Reverse Current		I_{rrm}		8		A

Rating and characteristic curves

Fig 1. SAFE OPERATION AREA

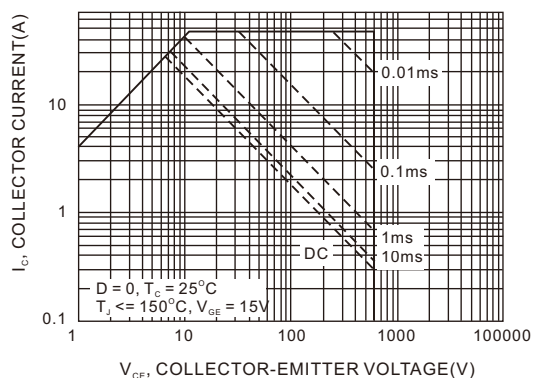


Fig 2. TYPICAL OUTPUT CHARACTERISTICS

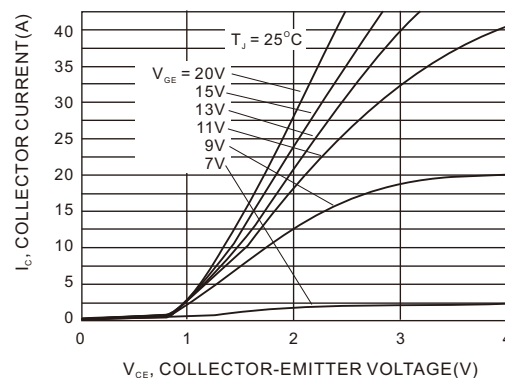


Fig 3. TYPICAL OUTPUT CHARACTERISTICS

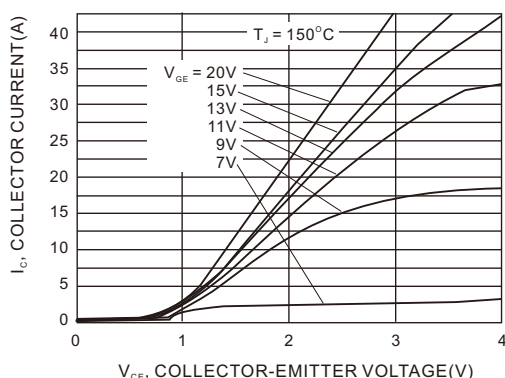


Fig 4. TYPICAL TRANSFER CHARACTERISTIC

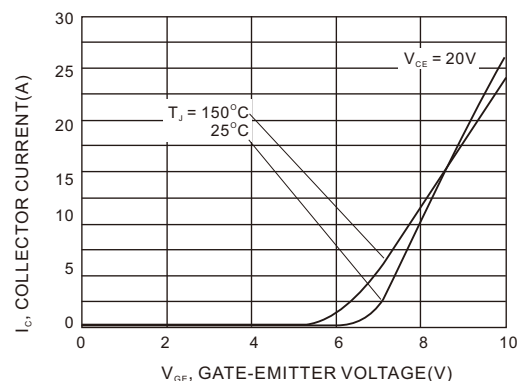


Fig 5. TYPICAL COLLECTOR-EMITTER SATURATION VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE

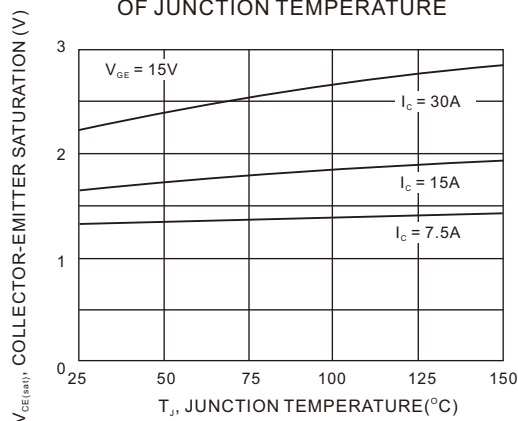


Fig 6. TYPICAL SWITCHING TIMES AS A FUNCTION OF COLLECTOR CURRENT

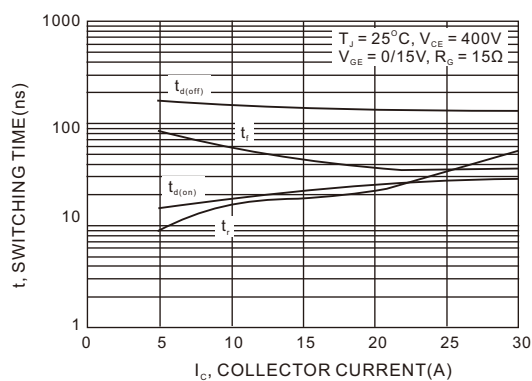


Fig 7. TYPICAL SWITCHING TIMES AS A FUNCTION OF GATE RESISTOR

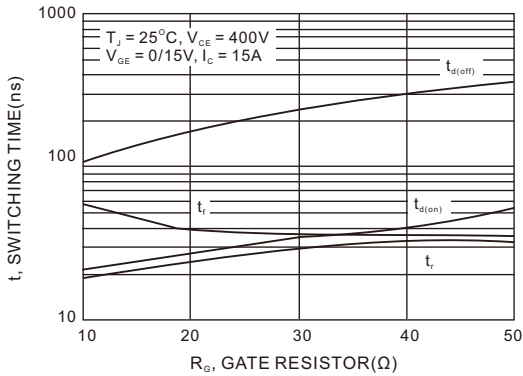


Fig 8. TYPICAL SWITCHING TIMES AS A FUNCTION OF JUNCTION TEMPERATURE

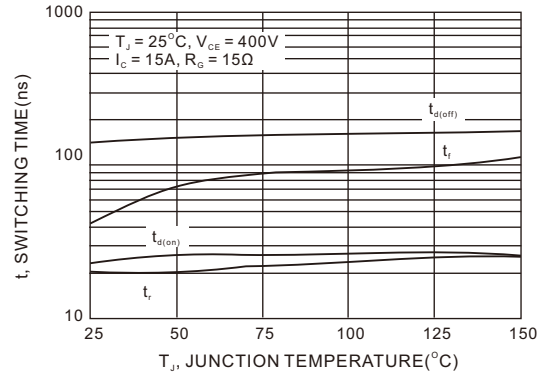


Fig 9. GATE-EMITTER THRESHOLD VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE

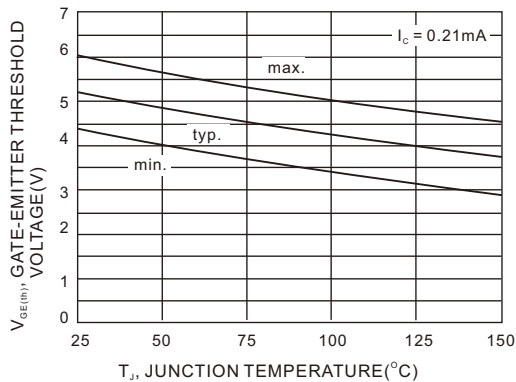


Fig 10. TYPICAL SWITCHING ENERGY LOSSES AS A FUNCTION OF COLLECTOR CURRENT

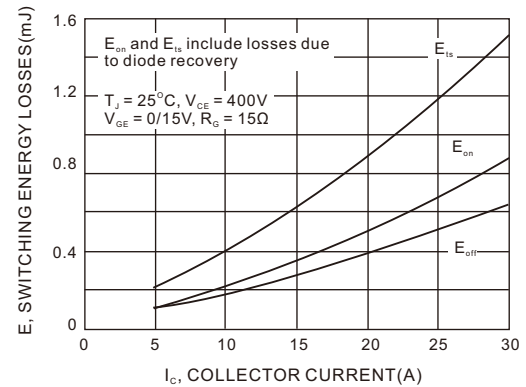


Fig 11. TYPICAL SWITCHING ENERGY LOSSES AS A FUNCTION OF GATE RESISTOR

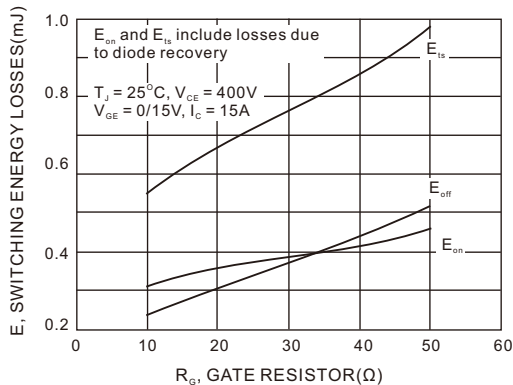


Fig 12. TYPICAL SWITCHING ENERGY LOSSES AS A FUNCTION OF COLLECTOR-EMITTER VOLTAGE

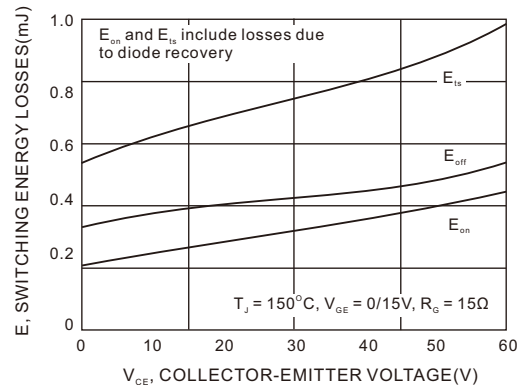


Fig 13. TYPICAL GATE CHARGE

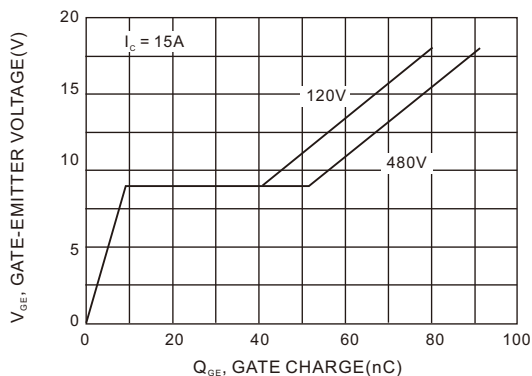


Fig 14. TYPICAL CAPACITANCE AS A FUNCTION OF COLLECTOR-EMITTER VOLTAGE

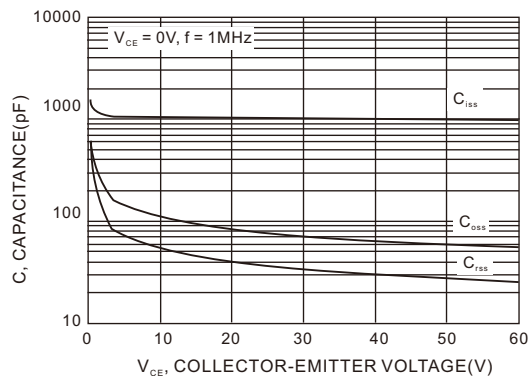


Fig 15. TYPICAL SHORT CIRCUIT COLLECTOR AS A FUNCTION OF GATE-EMITTER VOLTAGE

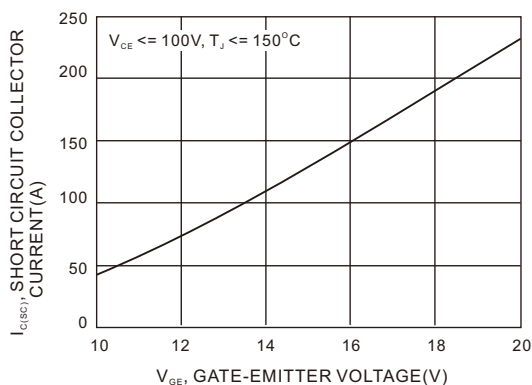


Fig 16. IGBT TRANSIENT THERMAL RESISTANCE

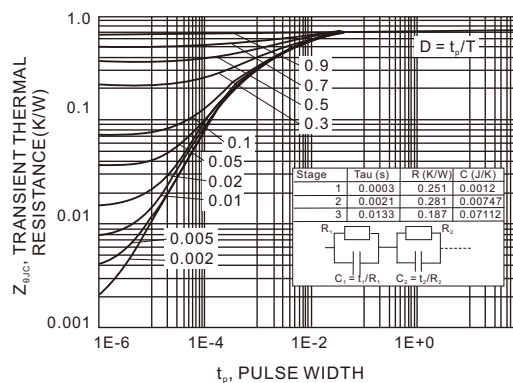


Fig 17. DIODE TRANSIENT THERMAL RESISTANCE

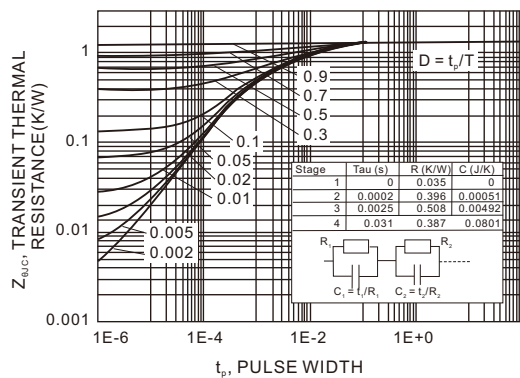


Fig 18. TYPICAL REVERSE RECOVERY TIME AS A FUNCTION OF DIODE CURRENT SLOPE

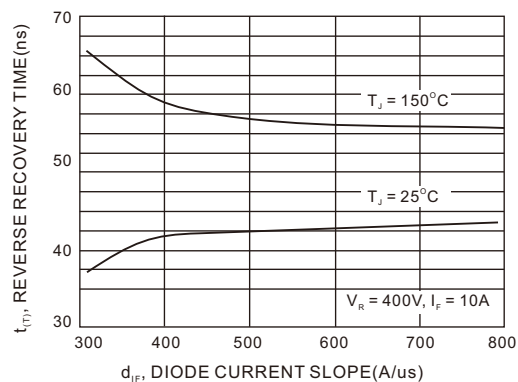


Fig 19. TYPICAL REVERSE RECOVERY CHARGE AS A FUNCTION OF DIODE CURRENT SLOPE

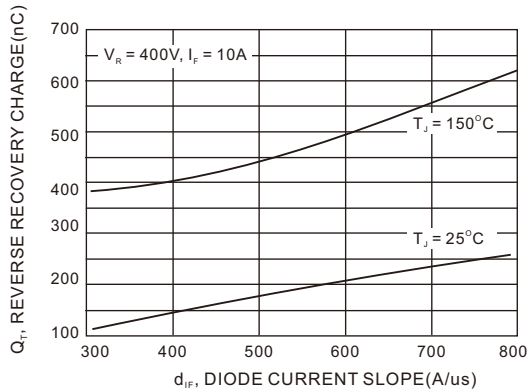


Fig 20. TYPICAL REVERSE RECOVERY CURRENT AS A FUNCTION OF DIODE CURRENT SLOPE

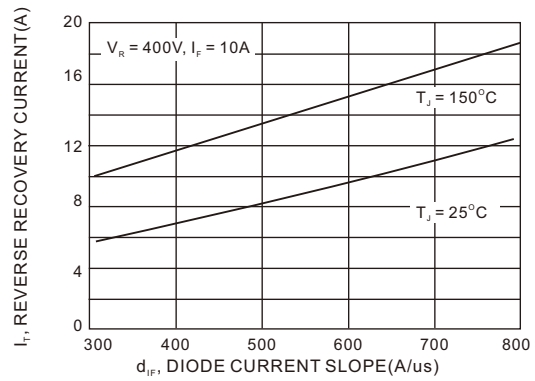


Fig 21. TYPICAL DIODE PEAK RATE OF FALL OF REVERSE RECOVERY CURRENT AS A FUNCTION OF DIODE CURRENT SLOPE

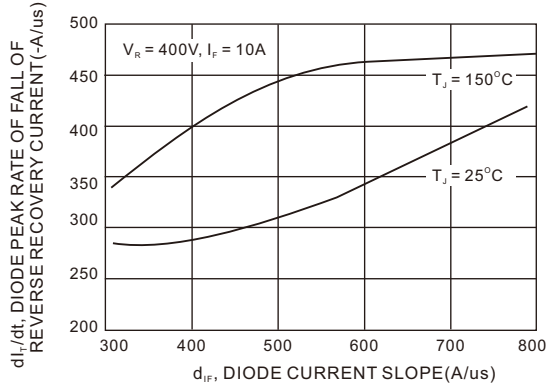


Fig 22. TYPICAL DIODE FORWARD CURRENT AS A FUNCTION OF FORWARD VOLTAGE

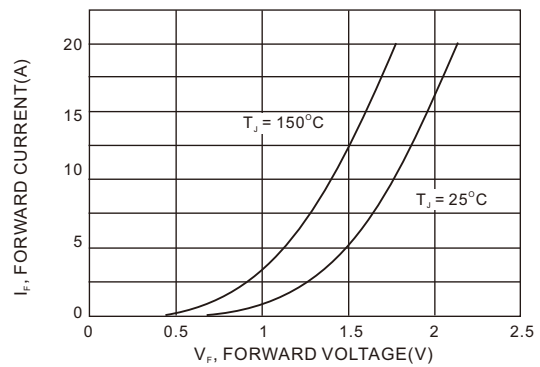


Fig 23. TYPICAL DIODE FORWARD VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE

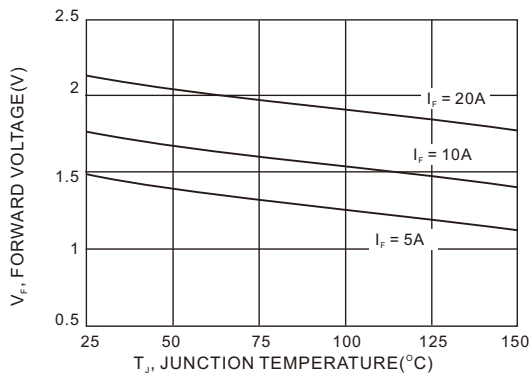


Fig A.DYNAMIC TEST CIRCUIT

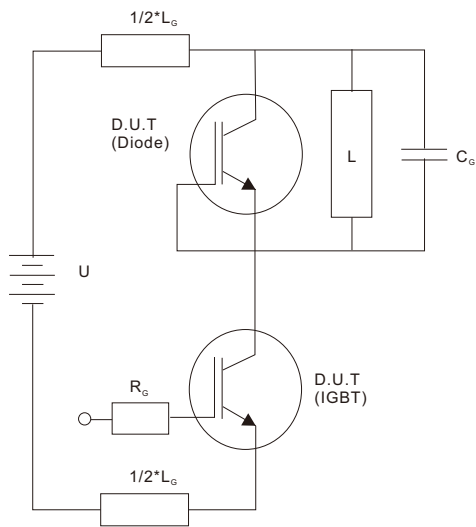


Fig B.DEFINITION OF SWITCHING LOSSES

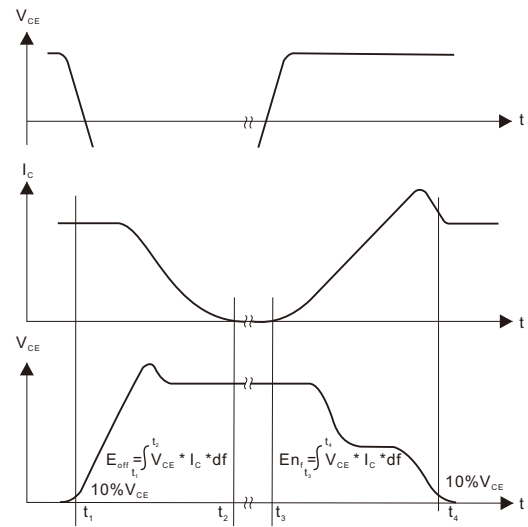


Fig C.DEFINITION OF DIODES SWITCHING CHARACTERISTICS

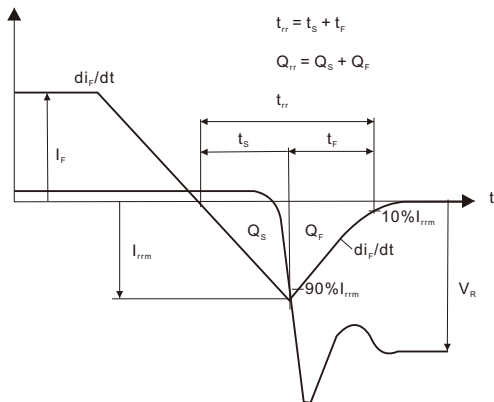
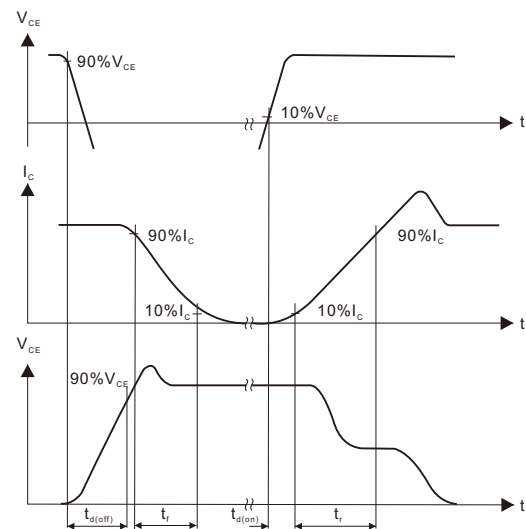


Fig D.DEFINITION OF SWITCHING TIMES



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