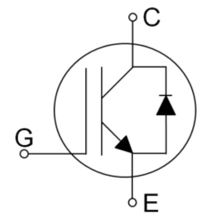
TGAN50N90FD
Field Stop Trench IGBT

Features
- 900V Field Stop Trench IGBT Technology
- High Speed Switching
- Low Conduction Loss
- Positive Temperature Coefficient
- Easy Parallel Operation
- 175℃ Operating Temperature
- RoHS Compliant
- JEDEC Qualification



Applications
- Induction Heating
- Inverterized microwave ovens
- Soft Switching Applications

Device	Package	Marking	Remark
TGAN50N90FD	TO-3PN	TGAN50N90FD	RoHS

Absolute Maximum Ratings

Parameter		Symbol	Value	Unit
Collector-Emitter Voltage		V_{CES}	900	V
Gate-Emitter Voltage		V_{GES}	±25	V
Continuous Collector Current	T_C = 25 ℃	I_C	100	A
	T_C = 100 ℃		50	A
Pulsed Collector Current (Note 1)		I_{CM}	200	A
Diode Continuous Forward Current	T_C = 100 ℃	I_F	50	A
Power Dissipation	T_C = 25 ℃	P_D	625	W
	T_C = 100 ℃		313	W
Operating Junction Temperature		T_{vj}	-55 ~ 175	℃
Storage Temperature Range		T_{STG}	-55 ~ 150	℃
Maximum lead temperature for soldering purposes, 1/8” from case for 5 seconds		T_L	300	℃

Notes :

(1) Repetitive rating : Pulse width limited by maximum junction temperature, During production, high current switching capability is 100% verified with the inductive load single-pulse switching test. (Ic=200A)

Thermal Characteristics

Parameter	Symbol	Value	Unit
Maximum Thermal resistance, Junction-to-Case	$R_{\theta JC}$ (IGBT)	0.24	℃/W
Maximum Thermal resistance, Junction-to-Case	$R_{\theta JC}$ (DIODE)	0.95	℃/W
Maximum Thermal resistance, Junction-to-Ambient	$R_{\theta JA}$	40	℃/W

Electrical Characteristics of the IGBT T_{vj}=25℃, unless otherwise noted

Parameter	Symbol	Test condition	Min.	Typ.	Max.	Unit
OFF						
Collector – Emitter Breakdown Voltage	BV_{CES}	V_{GE} = 0V, I_C = 1mA	900	--	--	V
Zero Gate Voltage Collector Current	I_{CES}	V_{CE} = 900V, V_{GE} = 0V	--	--	1	mA
Gate – Emitter Leakage Current	I_{GES}	V_{CE} = 0V, V_{GE} = ± 25V	--	--	± 500	nA
Integrated Gate Resistance	$R_{G(int)}$	f = 1MHz, Open Collector	--	4.9	--	Ω
ON						
Gate – Emitter Threshold Voltage	$V_{GE(TH)}$	V_{GE} = V_{CE}, I_C = 50mA	4.5	6.0	7.5	V
Collector – Emitter Saturation Voltage	$V_{CE(SAT)}$	V_{GE} = 15V, I_C = 50A, T_{vj} = 25 ℃	--	1.58	2.08	V
		V_{GE} = 15V, I_C = 50A, T_{vj} = 125 ℃	--	1.82	--	V
		V_{GE} = 15V, I_C = 50A, T_{vj} = 175 ℃	--	2.00	--	V
DYNAMIC						
Input Capacitance	C_{IES}	V_{CE} = 30V V_{GE} = 0V f = 1MHz	--	4352	--	pF
Output Capacitance	C_{OES}		--	94	--	pF
Reverse Transfer Capacitance	C_{RES}		--	63	--	pF
Total Gate Charge	Q_g	V_{CC} = 600V, I_C = 50A V_{GE} = 15V	--	228	341	nC
Gate-Emitter Charge	Q_{ge}		--	31	46	nC
Gate-Collector Charge	Q_{gc}		--	108	162	nC
SWITCHING (Note 2)						
Turn-On Delay Time	$t_{d(on)}$	V_{CC} = 600V, I_C = 25A R_G = 5Ω, V_{GE} = 15V Inductive Load, T_{vj} = 25 ℃	--	43	--	ns
Rise Time	t_r		--	20	--	ns
Turn-Off Delay Time	$t_{d(off)}$		--	244	--	ns
Fall Time	t_f		--	18	--	ns
Turn-On Switching Loss	E_{ON}		--	1.60	--	mJ
Turn-Off Switching Loss	E_{OFF}		--	0.70	--	mJ
Total Switching Loss	E_{TS}		--	2.30	--	mJ
Turn-On Delay Time	$t_{d(on)}$	V_{CC} = 600V, I_C = 50A R_G = 5Ω, V_{GE} = 15V Inductive Load, T_{vj} = 25 ℃	--	48	--	ns
Rise Time	t_r		--	30	--	ns
Turn-Off Delay Time	$t_{d(off)}$		--	212	--	ns
Fall Time	t_f		--	33	--	ns
Turn-On Switching Loss	E_{ON}		--	3.60	5.40	mJ
Turn-Off Switching Loss	E_{OFF}		--	1.44	2.16	mJ
Total Switching Loss	E_{TS}		--	5.04	7.56	mJ

Electrical Characteristics of the IGBT T_{vj}=25℃, unless otherwise noted

Parameter	Symbol	Test condition	Min.	Typ.	Max.	Unit
SWITCHING (Note 2)						
Turn-On Delay Time	$t_{d(on)}$	V_{CC} = 600V, I_C = 25A R_G = 5Ω, V_{GE} = 15V Inductive Load, T_{vj} = 175 ℃	--	44	--	ns
Rise Time	t_r		--	20	--	ns
Turn-Off Delay Time	$t_{d(off)}$		--	316	--	ns
Fall Time	t_f		--	80	--	ns
Turn-On Switching Loss	E_{ON}		--	2.42	--	mJ
Turn-Off Switching Loss	E_{OFF}		--	1.63	--	mJ
Total Switching Loss	E_{TS}		--	4.05	--	mJ
Turn-On Delay Time	$t_{d(on)}$	V_{CC} = 600V, I_C = 50A R_G = 5Ω, V_{GE} = 15V Inductive Load, T_{vj} = 175 ℃	--	51	--	ns
Rise Time	t_r		--	32	--	ns
Turn-Off Delay Time	$t_{d(off)}$		--	259	--	ns
Fall Time	t_f		--	111	--	ns
Turn-On Switching Loss	E_{ON}		--	4.53	6.80	mJ
Turn-Off Switching Loss	E_{OFF}		--	2.95	4.42	mJ
Total Switching Loss	E_{TS}		--	7.48	11.22	mJ

Notes :
(2) Not subject to production test – verified by design/characterization

Electrical Characteristics of the DIODE T_{vj}=25℃, unless otherwise noted

Parameter	Symbol	Test condition	Min.	Typ.	Max.	Unit
Diode Forward Voltage	V_{FM}	I_F = 25A, T_C = 25 ℃	--	2.00	--	V
		I_F = 25A, T_C = 125 ℃	--	2.08	--	V
		I_F = 25A, T_C = 175 ℃	--	2.10	--	V
		I_F = 50A, T_C = 25 ℃	--	2.50	--	V
		I_F = 50A, T_C = 125 ℃	--	2.71	--	V
		I_F = 50A, T_C = 175 ℃	--	2.78	--	V
Reverse Recovery Time	t_{rr}	I_F = 25A, di/dt = 200A/µs, T_{vj} = 25 ℃	--	202	--	ns
Reverse Recovery Current	I_{rr}		--	13.5	--	A
Reverse Recovery Charge	Q_{rr}		--	1810	--	nC
Reverse Recovery Time	t_{rr}	I_F = 25A, di/dt = 200A/µs, T_{vj} = 175 ℃	--	364	--	ns
Reverse Recovery Current	I_{rr}		--	18.7	--	A
Reverse Recovery Charge	Q_{rr}		--	4140	--	nC
Reverse Recovery Time	t_{rr}	I_F = 50A, di/dt = 200A/µs, T_{vj} = 25 ℃	--	291	--	ns
Reverse Recovery Current	I_{rr}		--	14.2	--	A
Reverse Recovery Charge	Q_{rr}		--	2440	--	nC
Reverse Recovery Time	t_{rr}	I_F = 50A, di/dt = 200A/µs, T_{vj} = 175 ℃	--	421	--	ns
Reverse Recovery Current	I_{rr}		--	20.8	--	A
Reverse Recovery Charge	Q_{rr}		--	5280	--	nC

IGBT Characteristics

Figure 1. IGBT Output Characteristics

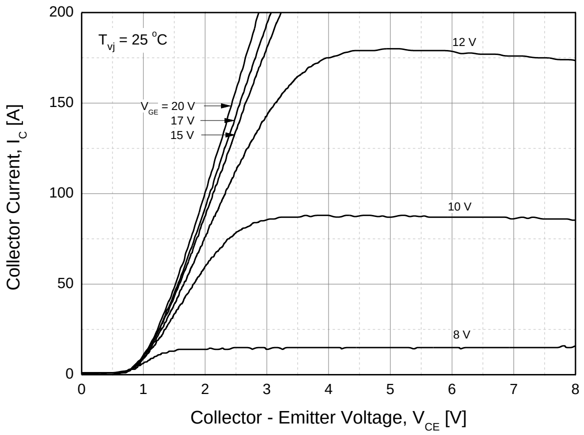


Figure 2. IGBT Output Characteristics

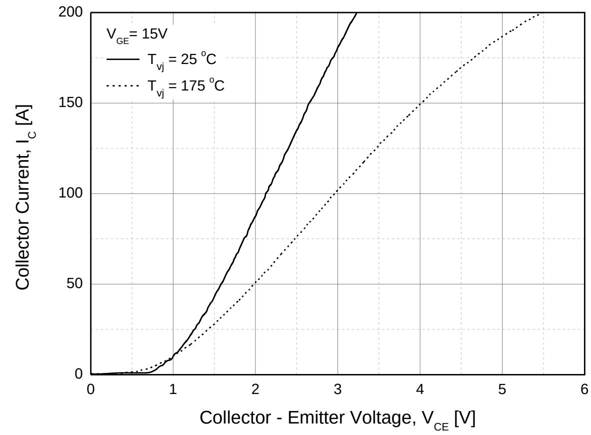


Figure 3. IGBT Saturation Voltage vs. Junction Temperature

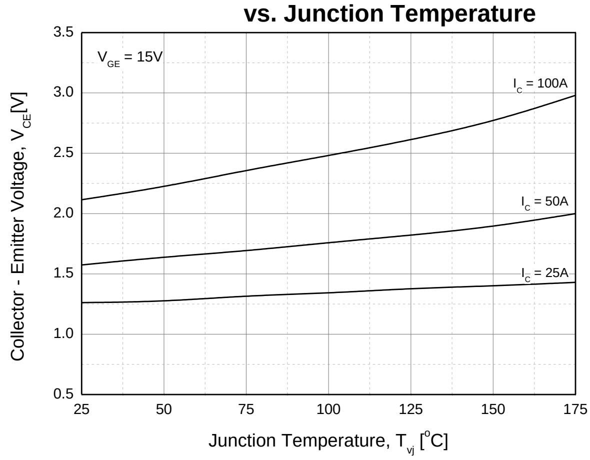


Figure 4. IGBT Saturation Voltage vs. Gate Bias

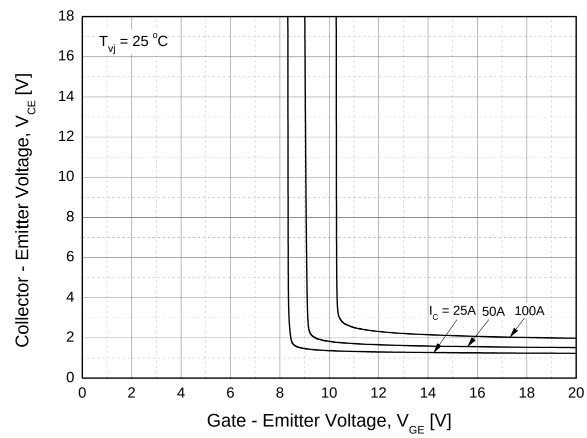


Figure 5. IGBT Saturation Voltage vs. Gate Bias

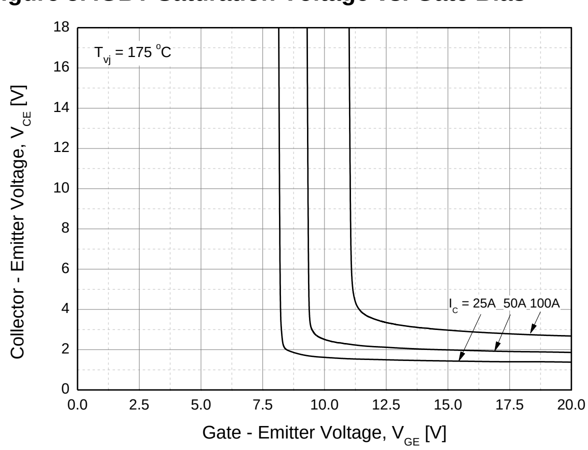
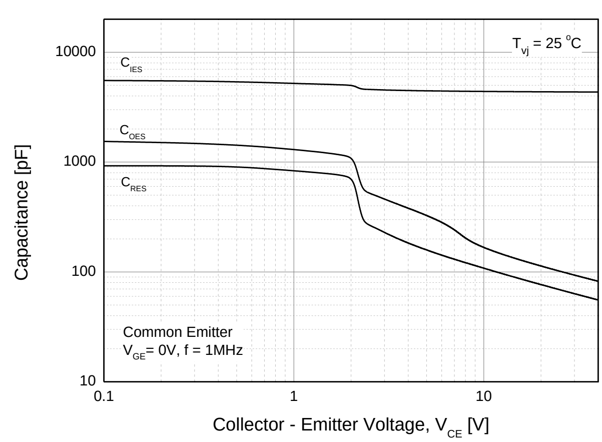


Figure 6. IGBT Capacitance Characteristics



IGBT Characteristics

Figure 7. Turn-on Time vs. Gate Resistor

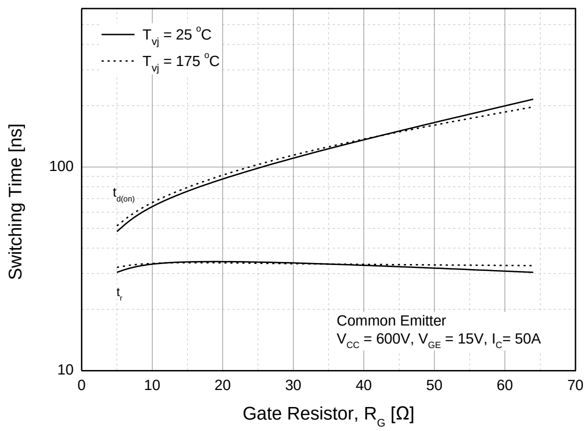


Figure 8. Turn-off Time vs. Gate Resistor

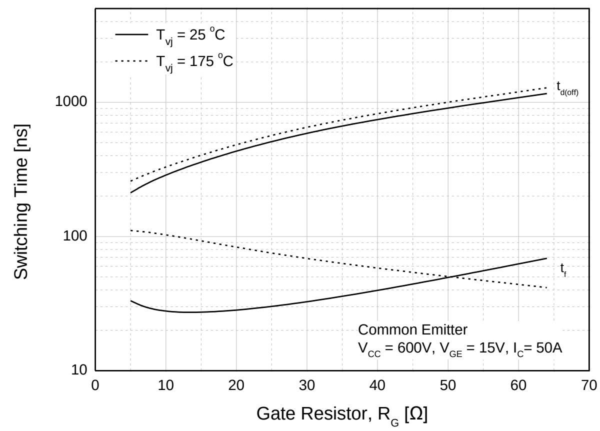


Figure 9. Switching Loss vs. Gate Resistor

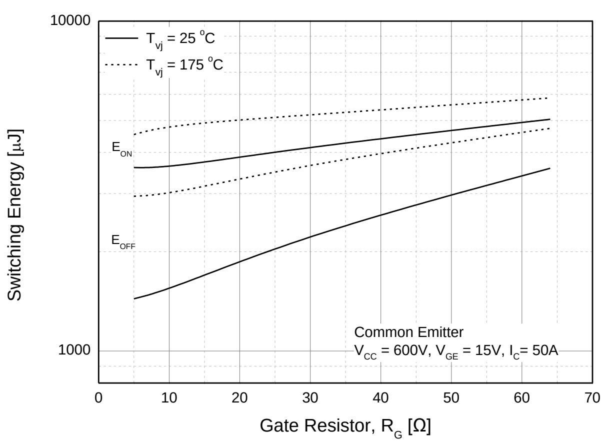


Figure 10. Turn-on Time vs. Collector Current

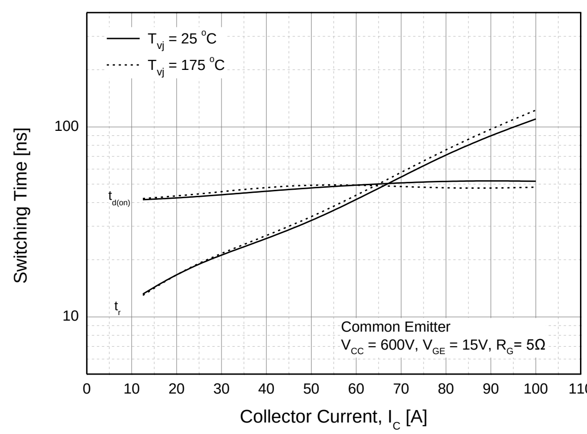


Figure 11. Turn-off Time vs. Collector Current

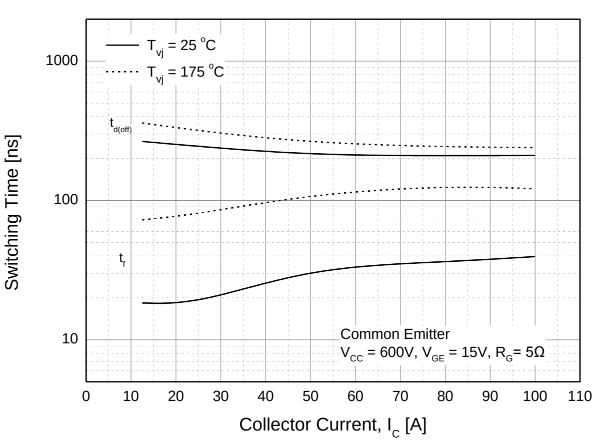
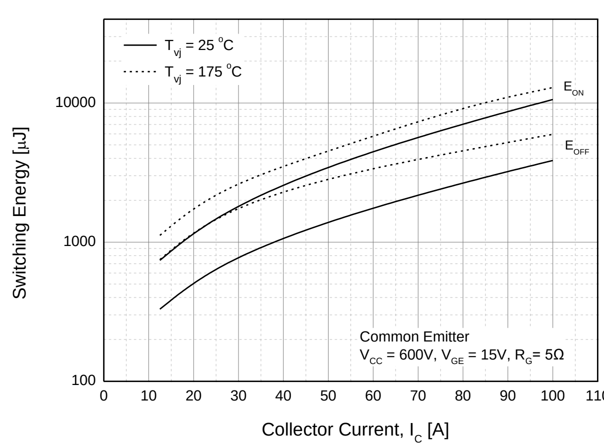


Figure 12. Switching Loss vs. Collector Current



IGBT Characteristics

Figure 13. Gate Charge Characteristics

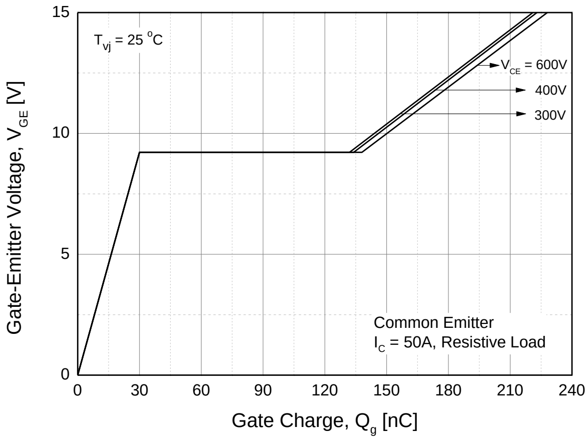


Figure 14. SOA

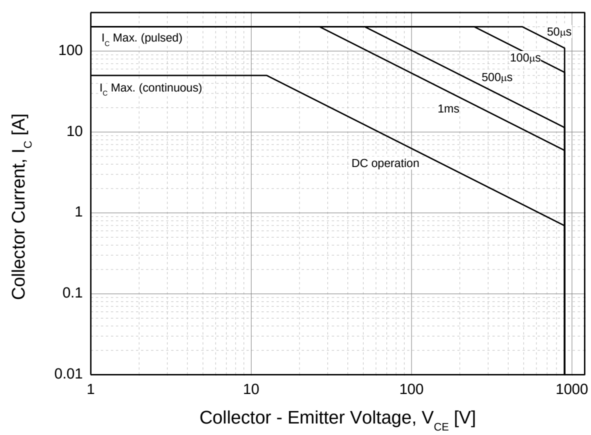


Figure 15. RBSOA

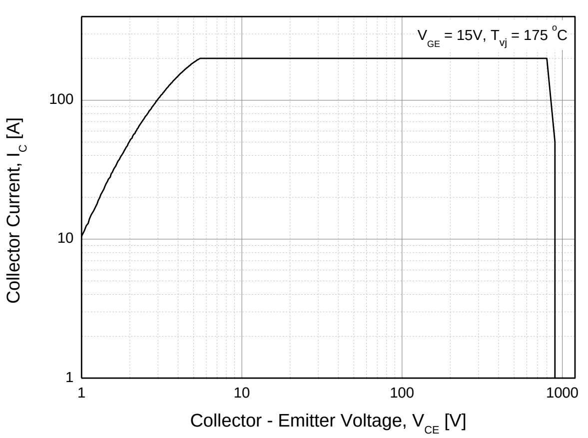


Figure 16. Transient Thermal Impedance of IGBT

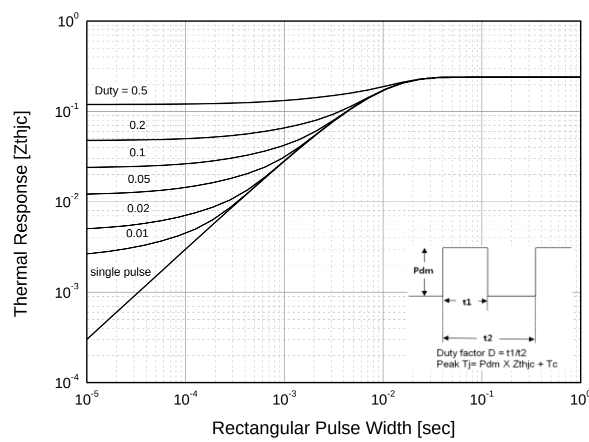
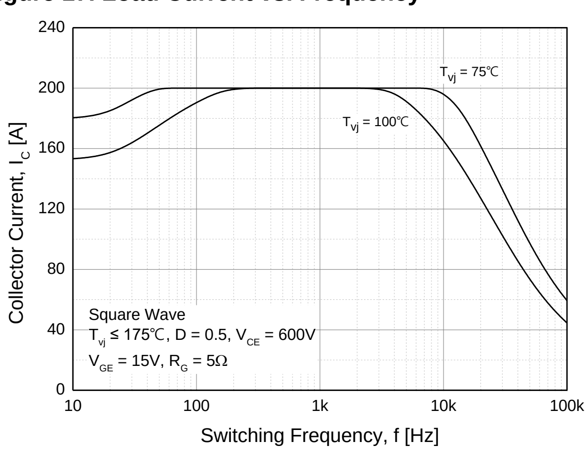


Figure 17. Load Current vs. Frequency



Diode Characteristics

Figure 18. Diode Conduction Characteristics

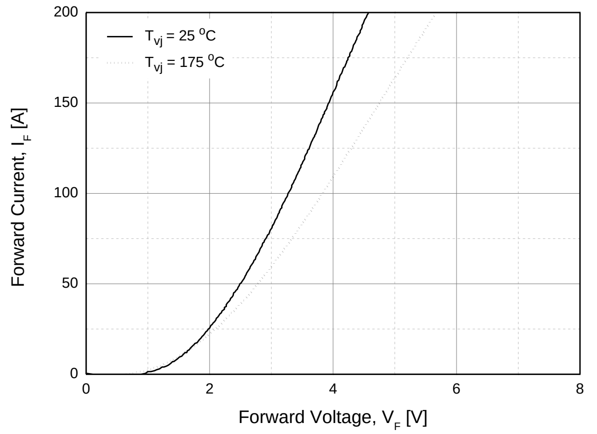


Figure 19. Reverse Recovery Current vs. Forward Current

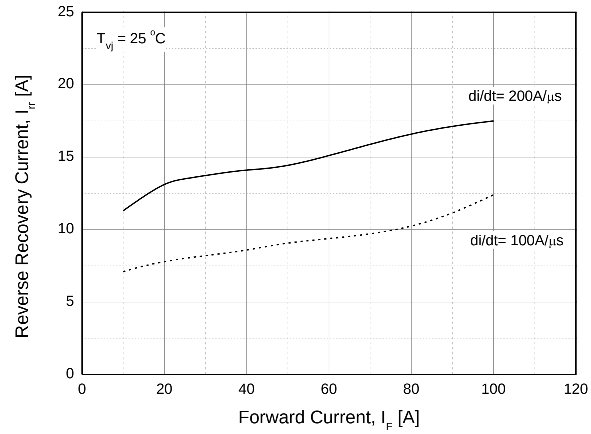


Figure 20. Reverse Recovery Charge vs. Forward Current

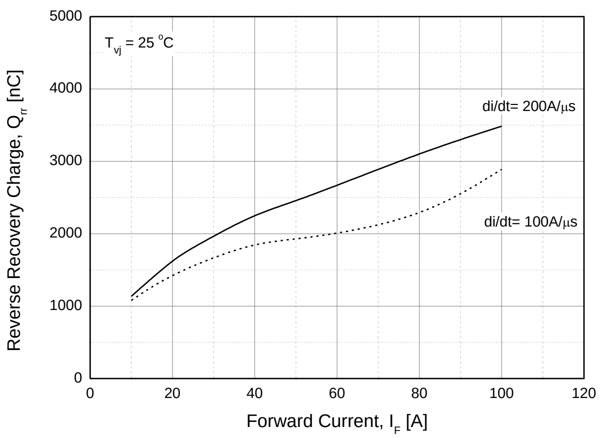
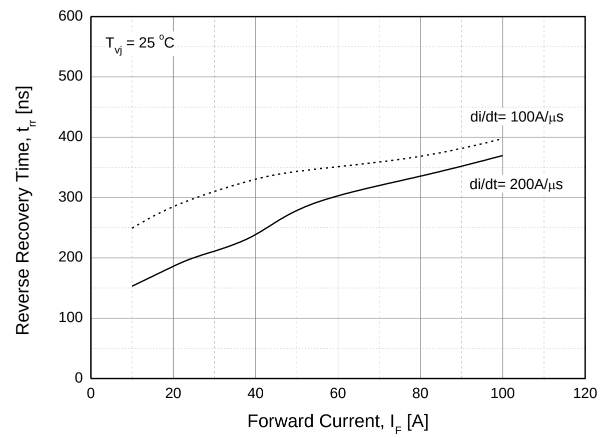
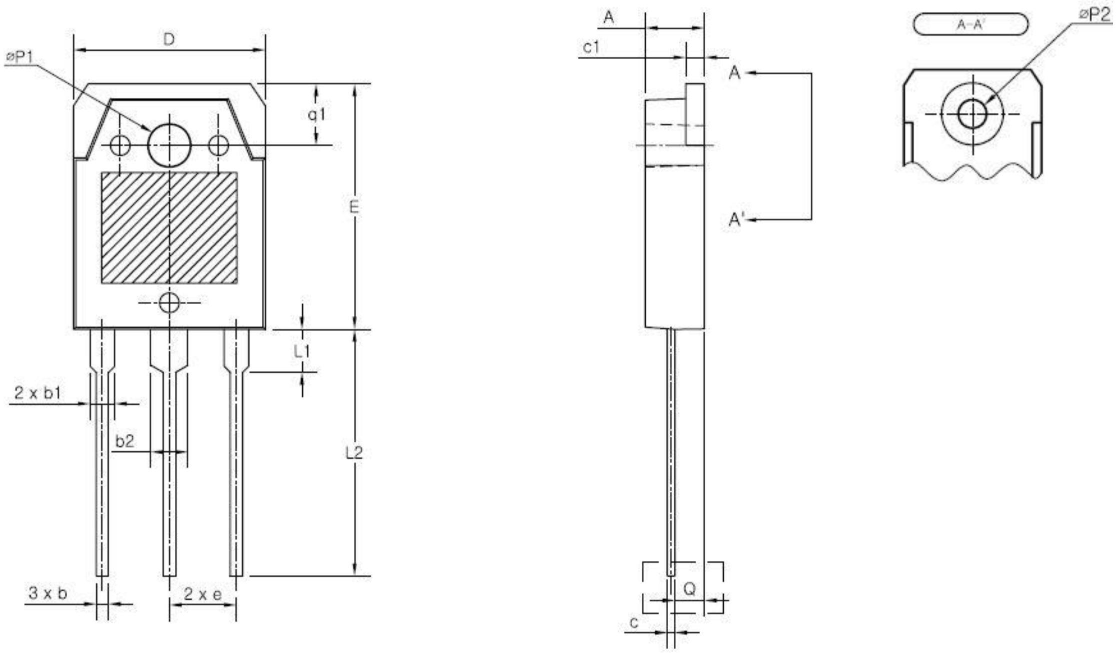


Figure 21. Reverse Recovery Time vs. Forward Current



TO-3PN MECHANICAL DATA



SYMBOL	MIN	NOM	MAX
A	4.60	4.80	5.00
b	0.80	1.00	1.20
b1	1.80	2.00	2.20
b2	2.80	3.00	3.20
c	0.55	0.60	0.75
c1	1.45	1.50	1.65
D	15.40	15.60	15.80
E	19.70	19.90	20.10
e	5.15	5.45	5.75
L1	3.30	3.50	3.70
L2	19.80	20.00	20.20
⌀P1	3.30	3.40	3.50
⌀P2		(3.20)	
Q	2.20	2.40	2.60
q1	4.80	5.00	5.20

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