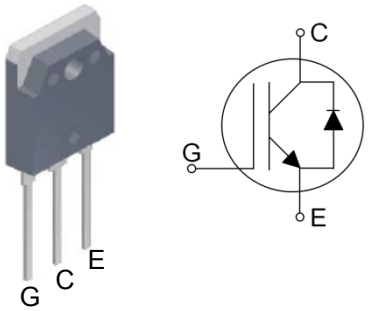
TGAN20N135FD
Field Stop Trench IGBT

Features:
- •1350V Field Stop Trench Technology
- • High Speed Switching
- • Low Conduction Loss
- • Positive Temperature Coefficient
- • Easy Parallel Operation
- • RoHS Compliant
- • JEDEC Qualification



Applications :
Induction Heating, Soft Switching Application, UPS, Welder, Inverter

Device	Package	Marking	Remark
TGAN20N135FD	TO-3PN	TGAN20N135FD	RoHS

Absolute Maximum Ratings

Parameter		Symbol	Value	Unit
Collector-Emitter Voltage		V_{CES}	1350	V
Gate-Emitter Voltage		V_{GES}	±20	V
Continuous Collector Current	T_C = 25 ℃	I_c	40	A
	T_C = 100 ℃		20	A
Pulsed Collector Current (Note 1)		I_{CM}	60	A
Diode Continuous Forward Current	T_C = 100 ℃	I_F	20	A
Power Dissipation	T_C = 25 ℃	P_D	223	W
	T_C = 100 ℃		86	W
Operating Junction Temperature		T_J	-55 ~ 150	℃
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

Thermal Characteristics

Parameter	Symbol	Value	Unit
Maximum Thermal resistance, Junction-to-Case	$R_{\theta JC}$ (IGBT)	0.56	℃/W
Maximum Thermal resistance, Junction-to-Case	$R_{\theta JC}$ (DIODE)	3	℃/W
Maximum Thermal resistance, Junction-to-Ambient	$R_{\theta JA}$	40	℃/W

Electrical Characteristics of the IGBT T_C=25℃, unless otherwise noted

Parameter	Symbol	Test condition	Min.	Typ.	Max.	Units
OFF						
Collector – Emitter Breakdown Voltage	BV_{CES}	V_{GE} = 0V, I_C = 1mA	1350	--	--	V
Zero Gate Voltage Collector Current	I_{CES}	V_{CE} = 1350V, V_{GE} = 0V	--	--	1	mA
Gate – Emitter Leakage Current	I_{GES}	V_{CE} = 0V, V_{GE} = ± 20V	--	--	± 250	nA
ON						
Gate – Emitter Threshold Voltage	$V_{GE(TH)}$	V_{GE} = V_{CE}, I_C = 20mA	4.0	6.0	8.0	V
Collector – Emitter Saturation Voltage	$V_{CE(SAT)}$	V_{GE} = 15V, I_C = 20A, T_C = 25 °C	1.5	1.8	2.3	V
		V_{GE} = 15V, I_C = 20A, T_C = 125 °C	--	2.2	--	V
DYNAMIC						
Input Capacitance	C_{IES}	V_{CE} = 30V, V_{GE} = 0V, f = 1MHz	--	1950	--	pF
Output Capacitance	C_{OES}		--	55	--	pF
Reverse Transfer Capacitance	C_{RES}		--	40	--	pF
SWITCHING						
Turn-On Delay Time	$t_{d(on)}$	V_{CC} = 600V, I_C = 20A, R_G = 10Ω, V_{GE} = 15V, Inductive Load, T_C = 25 °C	--	25	--	ns
Rise Time	t_r		--	30	--	ns
Turn-Off Delay Time	$t_{d(off)}$		--	175	--	ns
Fall Time	t_f		--	105	155	ns
Turn-On Switching Loss	E_{ON}		--	2.5	3.7	mJ
Turn-Off Switching Loss	E_{OFF}		--	0.76	1.15	mJ
Total Switching Loss	E_{TS}		--	3.26	4.85	mJ
Turn-On Delay Time	$t_{d(on)}$	V_{CC} = 600V, I_C = 20A, R_G = 10Ω, V_{GE} = 15V, Inductive Load, T_C = 125 °C	--	25	--	ns
Rise Time	t_r		--	30	--	ns
Turn-Off Delay Time	$t_{d(off)}$		--	190	--	ns
Fall Time	t_f		--	235	--	ns
Turn-On Switching Loss	E_{ON}		--	2.5	3.7	mJ
Turn-Off Switching Loss	E_{OFF}		--	1.52	2.28	mJ
Total Switching Loss	E_{TS}		--	4.02	5.98	mJ
Total Gate Charge	Q_g	V_{CC} = 600V, I_C = 20A, V_{GE} = 15V	--	120	180	nC
Gate-Emitter Charge	Q_{ge}		--	15	20	nC
Gate-Collector Charge	Q_{gc}		--	60	90	nC

Electrical Characteristics of the DIODE T_C=25℃, unless otherwise noted

Parameter	Symbol	Test condition		Min.	Typ.	Max.	Units
Diode Forward Voltage	V_{FM}	I_F = 20A	T_C = 25 °C	--	2.4	2.8	V
			T_C = 125 °C	--	2.75	--	
Reverse Recovery Time	t_{rr}	I_F = 20A, di/dt = 200A/μs	T_C = 25 °C	--	265	425	ns
			T_C = 125 °C	--	295	--	
Reverse Recovery Current	I_{rr}		T_C = 25 °C	--	23	35	A
			T_C = 125 °C	--	28.5	--	
Reverse Recovery Charge	Q_{rr}		T_C = 25 °C	--	3030	6000	nC
			T_C = 125 °C	--	4170	--	

IGBT Characteristics

Fig. 1 Output characteristics

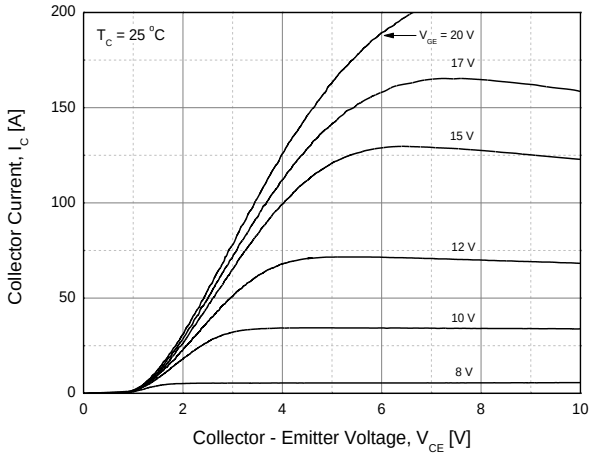


Fig. 2 Saturation voltage characteristics

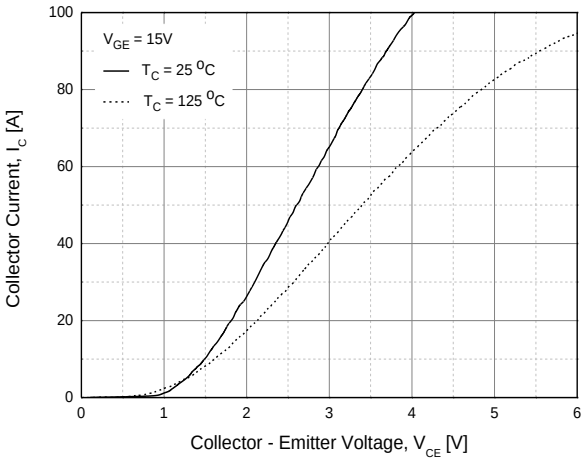


Fig. 3 Saturation voltage vs. collector current

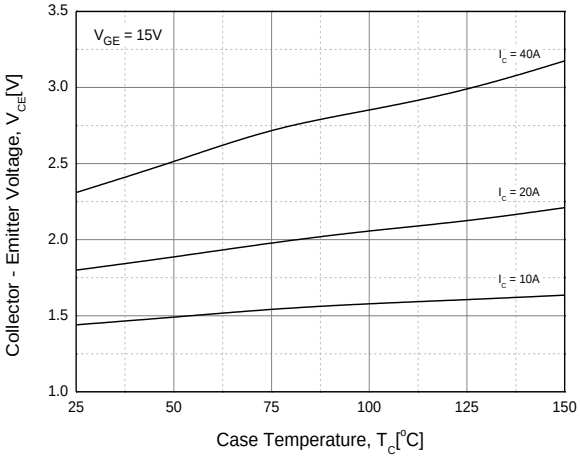


Fig. 4 Saturation voltage vs. gate bias

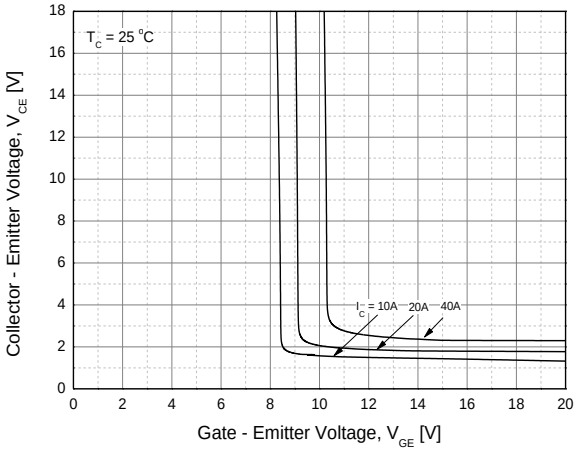


Fig. 5 Saturation voltage vs. gate bias

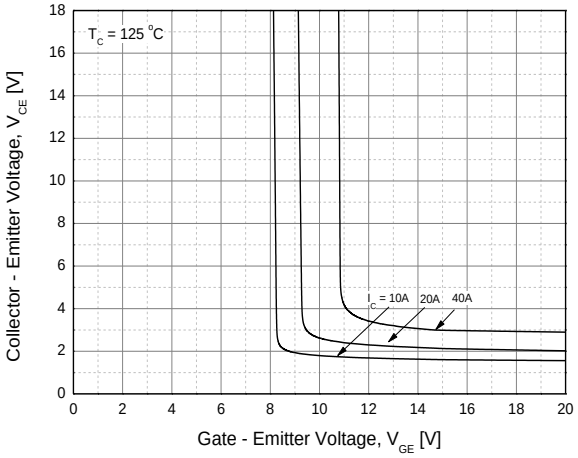
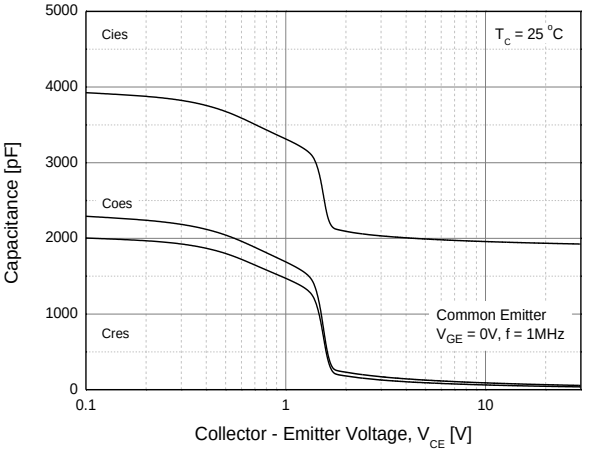


Fig. 6 Capacitance characteristics



IGBT Characteristics

Fig. 7 Turn-on time vs. gate resistor

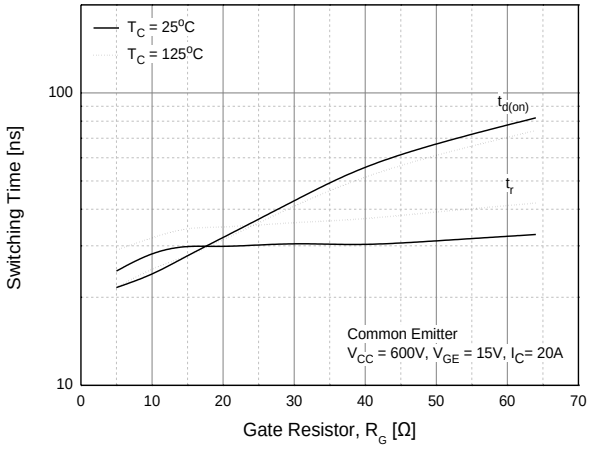


Fig. 8 Turn-off time vs. gate resistor

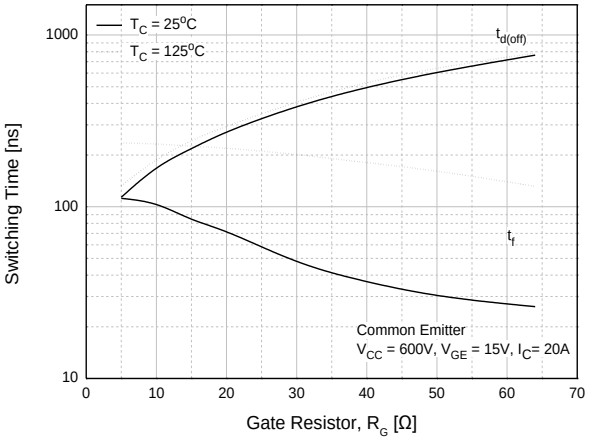


Fig. 9 Switching loss vs. gate resistor

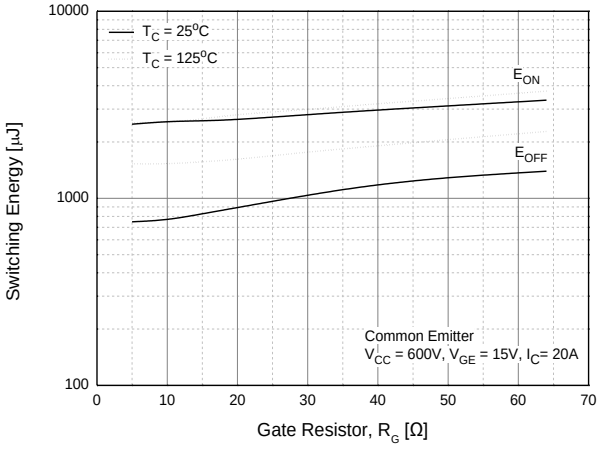


Fig. 10 Turn-on time vs. collector current

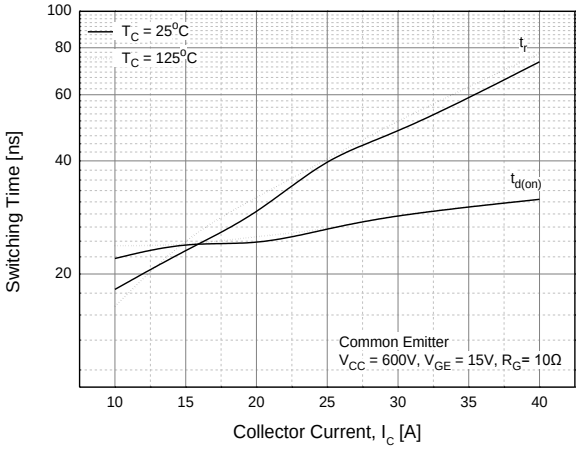


Fig. 11 Turn-off time vs. collector current

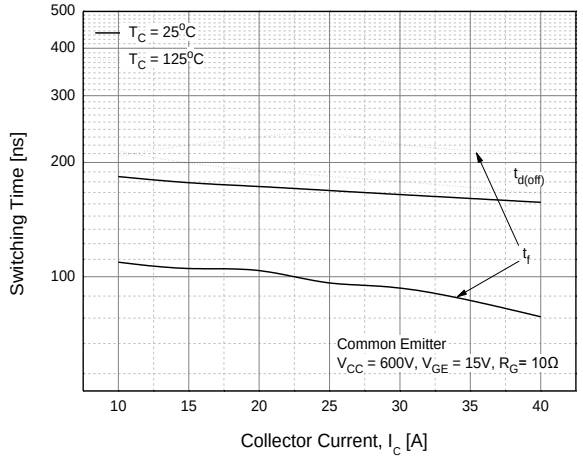
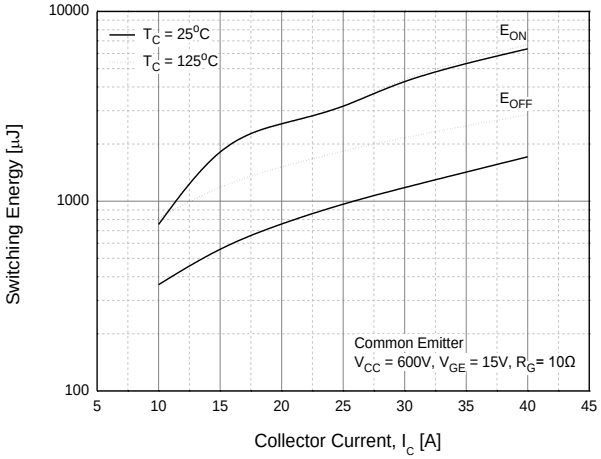


Fig. 12 Switching loss vs. collector current



IGBT Characteristics

Fig. 13 Gate charge characteristics

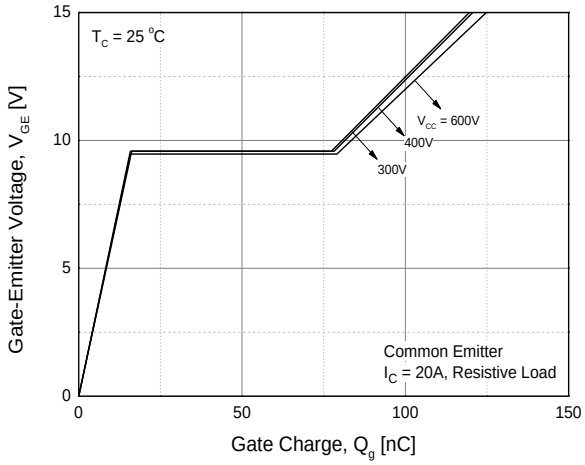


Fig. 14 SOA

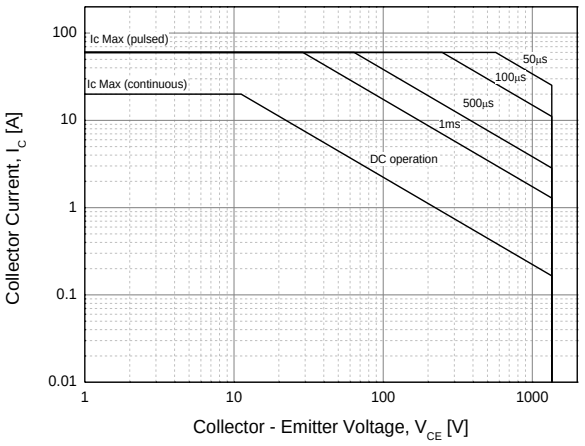


Fig. 15 RBSOA

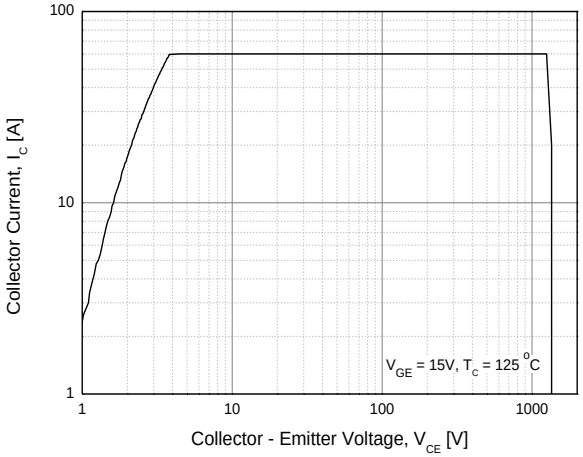


Fig. 16 Transient thermal impedance of IGBT

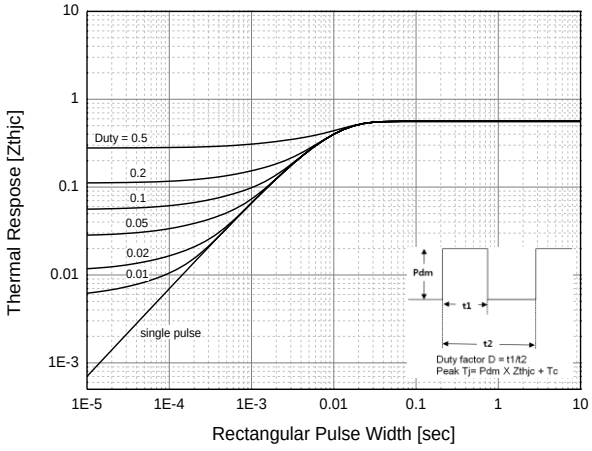
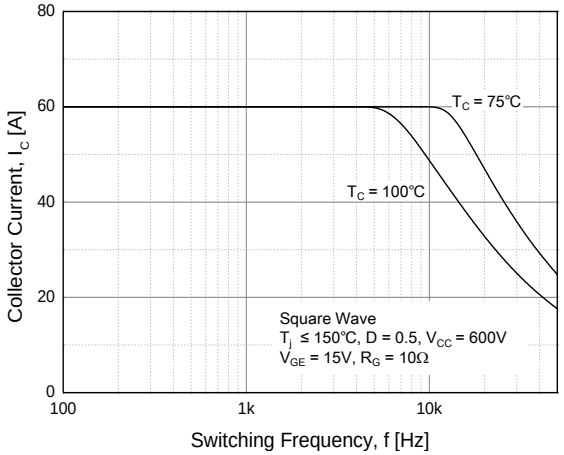


Fig. 17 Load Current vs. Frequency



Diode Characteristics

Fig. 18 Conduction characteristics

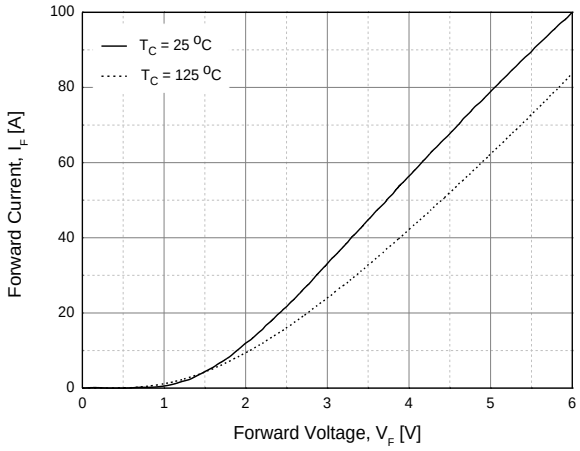


Fig. 19 Reverse recovery current vs. forward current

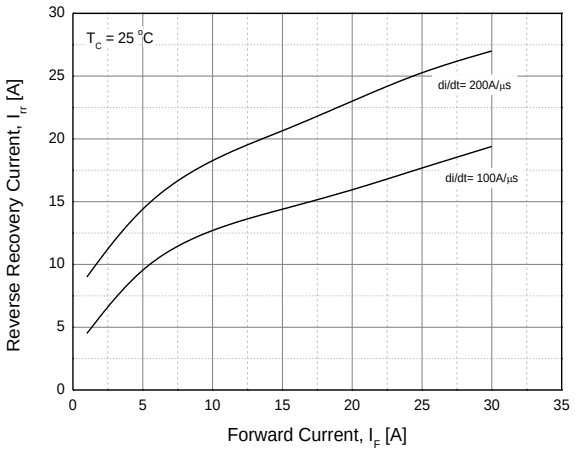


Fig. 20 Reverse recovery charge vs. forward current

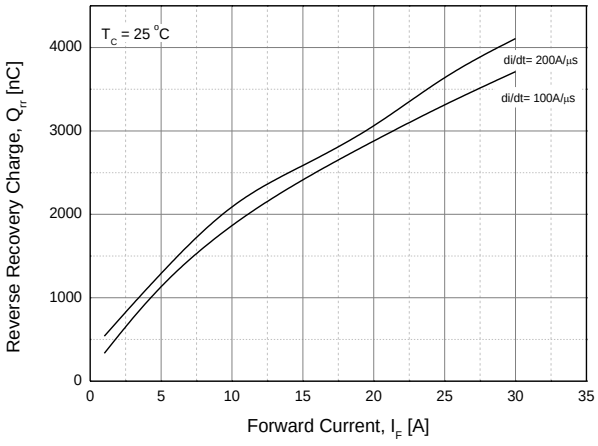
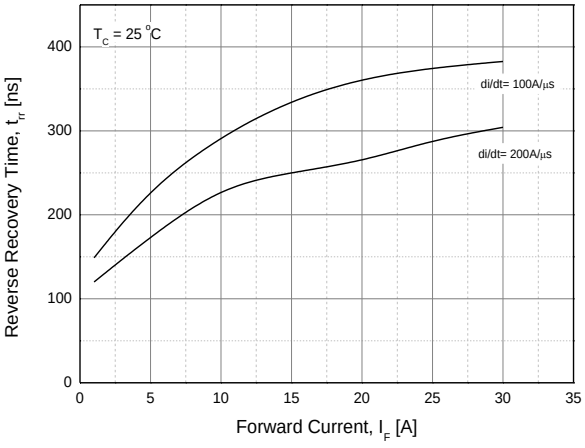
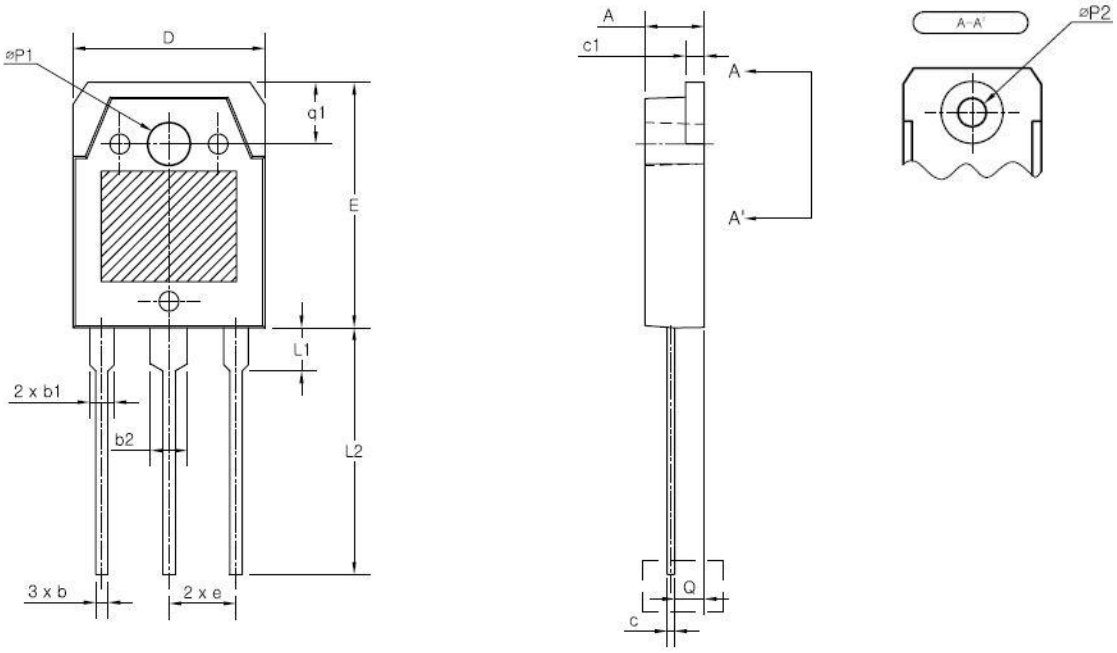


Fig. 21 Reverse recovery time vs. forward current



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
øP1	3.30	3.40	3.50
øP2		(3.20)	
Q	2.20	2.40	2.60
q1	4.80	5.00	5.20

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