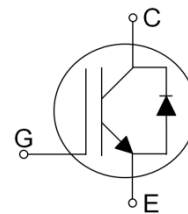


Features

- 1200V Field Stop Trench Technology
- High Speed Switching
- Low Conduction Loss
- Positive Temperature Coefficient
- Easy Parallel Operation
- Short Circuit Withstanding Time 5 s
- RoHS Compliant
- JEDEC Qualification



G C E

Applications

UPS, Welder, Inverter, Solar

Device	Package	Marking	Remark
TGAN40N120FDR	TO-3PN	TGAN40N120FDR	RoHS

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CES}	1200	V
Gate-Emitter Voltage	V_{GES}	± 25	V
Continuous Collector Current	I_C	$T_C = 25\text{ }^\circ\text{C}$	80
		$T_C = 100\text{ }^\circ\text{C}$	40
Pulsed Collector Current (Note 1)	I_{CM}	120	A
Diode Continuous Forward Current	I_F	40	A
Power Dissipation	P_D	$T_C = 25\text{ }^\circ\text{C}$	500
		$T_C = 100\text{ }^\circ\text{C}$	200
Operating Junction Temperature	T_{vj}	-55 ~ 150	$^\circ\text{C}$
Storage Temperature Range	T_{STG}	-55 ~ 150	$^\circ\text{C}$
Maximum lead temperature for soldering purposes,	T_L	300	$^\circ\text{C}$

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. ($I_C=120\text{A}$)

Thermal Characteristics

Parameter	Symbol	Value	Unit
Maximum Thermal resistance, Junction-to-Case	R_{JC} (IGBT)	0.25	$^\circ\text{C/W}$
Maximum Thermal resistance, Junction-to-Case	R_{JC} (DIODE)	0.95	$^\circ\text{C/W}$
Maximum Thermal resistance, Junction-to-Ambient	R_{JA}	40	$^\circ\text{C/W}$

Electrical Characteristics of the IGBT $T_{vj}=25^{\circ}\text{C}$, unless otherwise noted

Parameter	Symbol	Test condition	Min.	Typ.	Max.	Unit
OFF						
Collector Emitter Breakdown Voltage	BV_{CES}	$V_{GE} = 0V, I_C = 1mA$	1200	--	--	V
Zero Gate Voltage Collector Current	I_{CES}	$V_{CE} = 1200V, V_{GE} = 0V$	--	--	1	mA
Gate Emitter Leakage Current	I_{GES}	$V_{CE} = 0V, V_{GE} = \pm 25V$	--	--	± 500	nA
Integrated Gate Resistance	$R_{G(int)}$	$f = 1MHz, \text{Open Collector}$	--	2.7	--	
ON						
Gate Emitter Threshold Voltage	$V_{GE(TH)}$	$V_{GE} = V_{CE}, I_C = 40mA$	4.5	6.0	7.5	V
Collector Emitter Saturation Voltage	$V_{CE(SAT)}$	$V_{GE} = 15V, I_C = 40A, T_{vj} = 25^{\circ}\text{C}$	--	2.0	2.5	V
		$V_{GE} = 15V, I_C = 40A, T_{vj} = 150^{\circ}\text{C}$	--	2.3	--	V
DYNAMIC						
Input Capacitance	C_{IES}	$V_{CE} = 30V$ $V_{GE} = 0V$ $f = 1MHz$	--	5260	--	pF
Output Capacitance	C_{OES}		--	170	--	pF
Reverse Transfer Capacitance	C_{RES}		--	115	--	pF
Total Gate Charge	Q_g	$V_{CC} = 600V, I_C = 40A$ $V_{GE} = 15V$	--	320	480	nC
Gate-Emitter Charge	Q_{ge}		--	50	75	nC
Gate-Collector Charge	Q_{gc}		--	160	240	nC
SWITCHING (Note 2)						
Turn-On Delay Time	$t_{d(on)}$	$V_{CC} = 600V, I_C = 20A$ $R_G = 5, V_{GE} = 15V$ Inductive Load, $T_{vj} = 25^{\circ}\text{C}$	--	23	--	ns
Rise Time	t_r		--	28	--	ns
Turn-Off Delay Time	$t_{d(off)}$		--	209	--	ns
Fall Time	t_f		--	27	--	ns
Turn-On Switching Loss	E_{ON}		--	1.57	--	mJ
Turn-Off Switching Loss	E_{OFF}		--	0.31	--	mJ
Total Switching Loss	E_{TS}	--	1.88	--	mJ	
Turn-On Delay Time	$t_{d(on)}$	$V_{CC} = 600V, I_C = 40A$ $R_G = 5, V_{GE} = 15V$ Inductive Load, $T_{vj} = 25^{\circ}\text{C}$	--	29	--	ns
Rise Time	t_r		--	46	--	ns
Turn-Off Delay Time	$t_{d(off)}$		--	169	--	ns
Fall Time	t_f		--	30	--	ns
Turn-On Switching Loss	E_{ON}		--	3.66	5.49	mJ
Turn-Off Switching Loss	E_{OFF}		--	0.79	1.19	mJ
Total Switching Loss	E_{TS}	--	4.45	6.68	mJ	

Electrical Characteristics of the IGBT $T_{vj}=25^{\circ}\text{C}$, unless otherwise noted

Parameter	Symbol	Test condition	Min.	Typ.	Max.	Unit
SWITCHING (Note 2)						
Turn-On Delay Time	$t_{d(on)}$	$V_{CC} = 600\text{V}, I_C = 20\text{A}$ $R_G = 5 \Omega, V_{GE} = 15\text{V}$ Inductive Load, $T_{vj} = 150^{\circ}\text{C}$	--	25	--	ns
Rise Time	t_r		--	28	--	ns
Turn-Off Delay Time	$t_{d(off)}$		--	204	--	ns
Fall Time	t_f		--	130	--	ns
Turn-On Switching Loss	E_{ON}		--	2.40	--	mJ
Turn-Off Switching Loss	E_{OFF}		--	0.84	--	mJ
Total Switching Loss	E_{TS}		--	3.24	--	mJ
Turn-On Delay Time	$t_{d(on)}$	$V_{CC} = 600\text{V}, I_C = 40\text{A}$ $R_G = 5 \Omega, V_{GE} = 15\text{V}$ Inductive Load, $T_{vj} = 150^{\circ}\text{C}$	--	28	--	ns
Rise Time	t_r		--	46	--	ns
Turn-Off Delay Time	$t_{d(off)}$		--	187	--	ns
Fall Time	t_f		--	147	--	ns
Turn-On Switching Loss	E_{ON}		--	4.92	7.38	mJ
Turn-Off Switching Loss	E_{OFF}		--	1.82	2.73	mJ
Total Switching Loss	E_{TS}		--	6.74	10.1	mJ
Short Circuit Withstanding Time	t_{SC}	$V_{CC} = 600\text{V}, V_{GE} = 15\text{V}, T_{vj} = 125^{\circ}\text{C}$	5	10	--	s

Notes :

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

IGBT Characteristics

Fig. 7 Turn-on Time vs. Gate Resistor

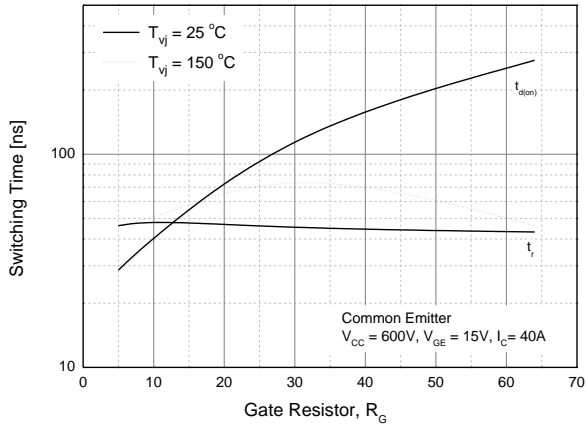


Fig. 8 Turn-off Time vs. Gate Resistor

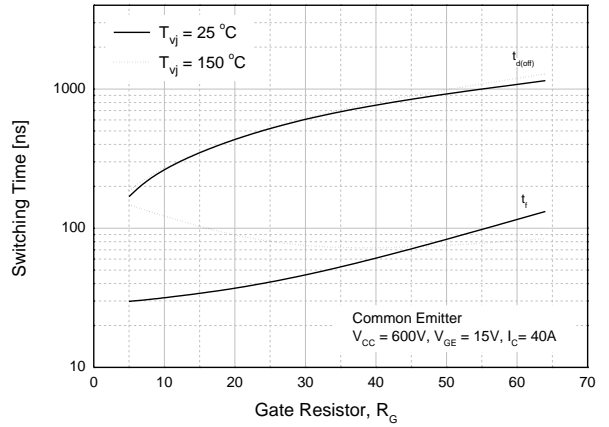


Fig. 9 Switching Loss vs. Gate Resistor

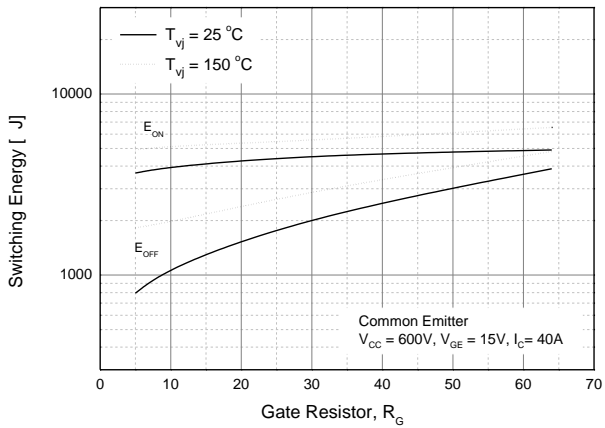


Fig. 10 Turn-on Time vs. Collector Current



Fig. 11 Turn-off Time vs. Collector Current

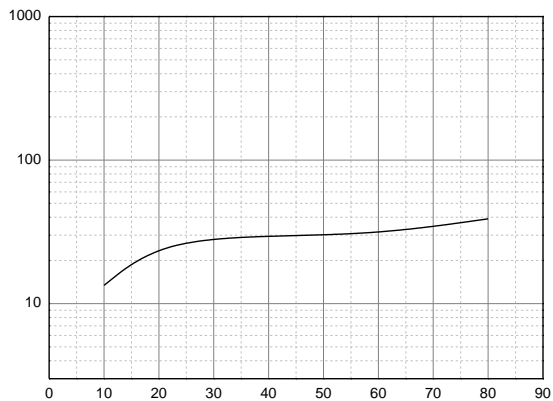
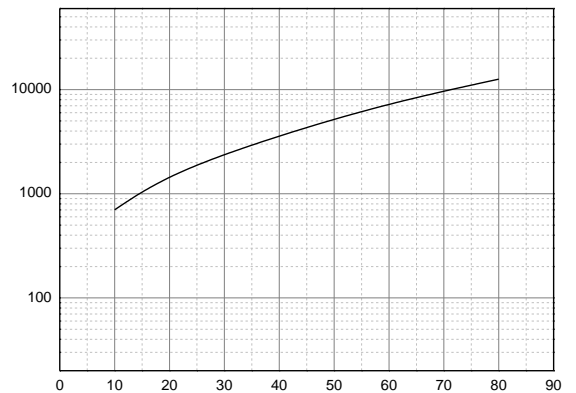


Fig. 12 Switching Loss vs. Collector Current



IGBT Characteristics

Fig. 13 Gate Charge characteristics

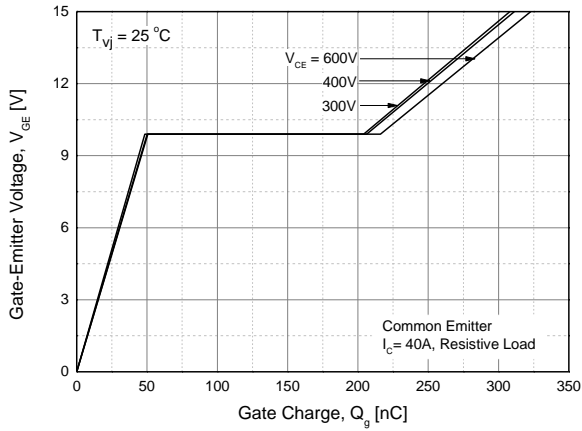


Fig. 14 SOA

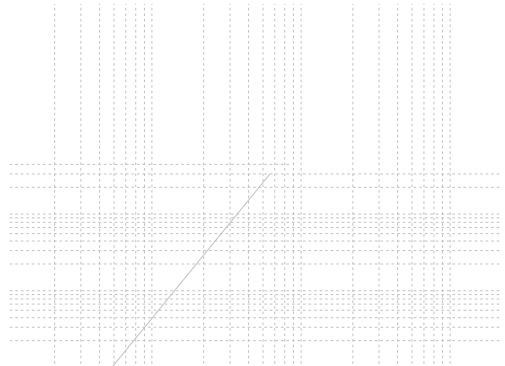
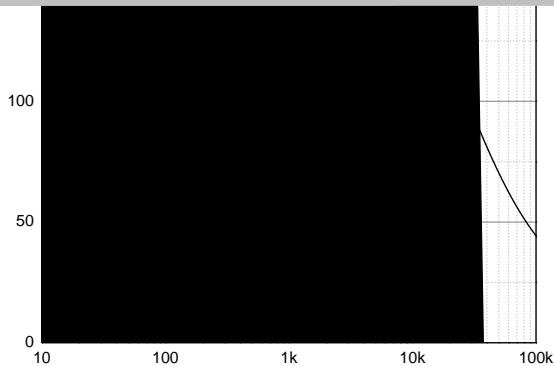


Fig. 15 RBSOA

Fig. 16 Transient Thermal Impedance of IGBT

Fig. 17 Load Current vs. Frequency



Diode Characteristics

Fig. 18 Diode Conduction Characteristics

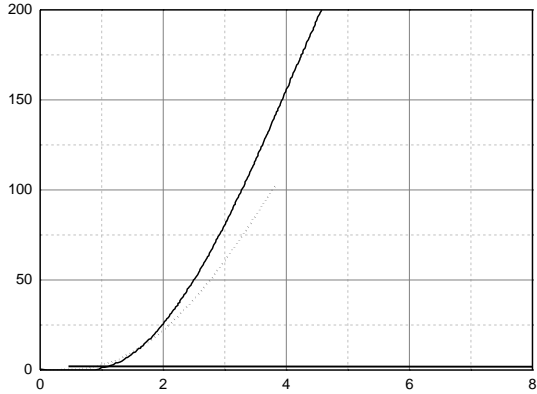


Fig. 19 Reverse Recovery Current vs. Forward Current

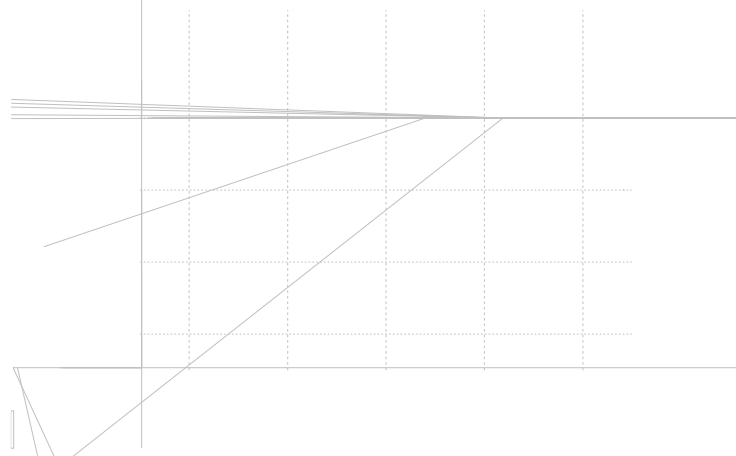


Fig. 20 Reverse Recovery Charge vs. Forward Current

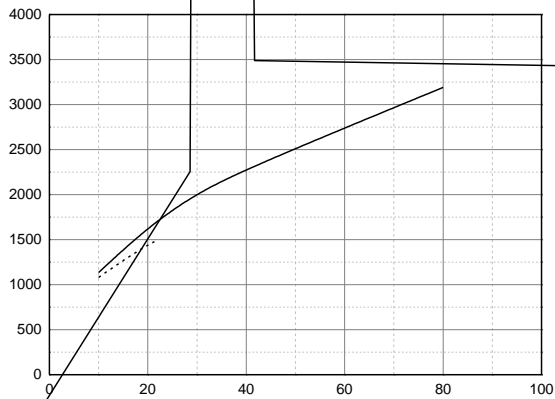
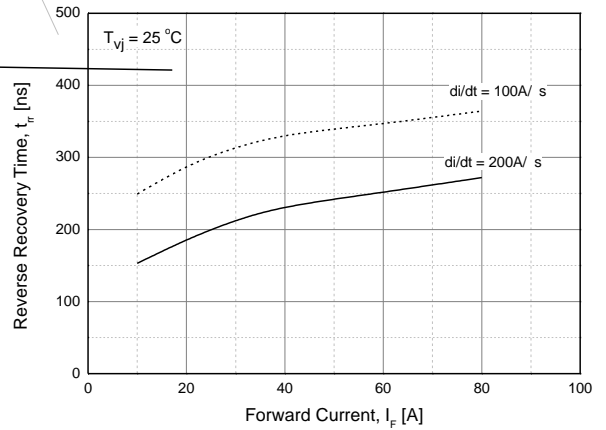
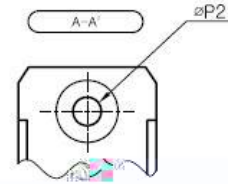
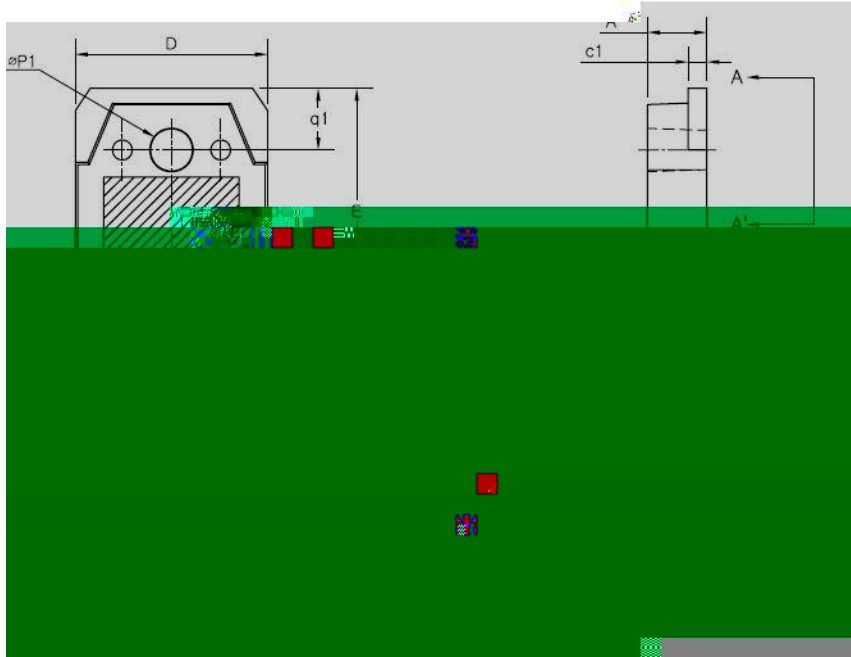


Fig. 21 Reverse Recovery Time vs. Forward Current



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
Q	2.20	2.40	2.60
q1	4.80	5.00	5.20

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