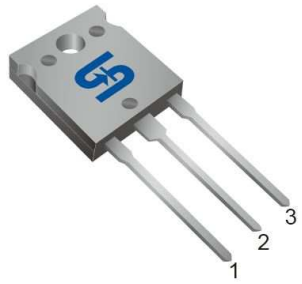
TSG40N120CE

N-Channel IGBT with FRD.

TO-264



Pin Definition:
1. Gate
2. Collector
3. Emitter

PRODUCT SUMMARY

V_{CES} (V)	V_{GES} (V)	I_C (A)
1200	±20	40

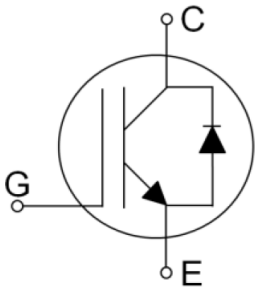
General Description

The TSG40N120CE using proprietary trench design and advanced NPT technology, the 1200V NPT IGBT offers superior conduction and switching performances, high avalanche ruggedness and easy parallel operation. This device is well suited for the resonant or soft switching application such as induction heating, microwave oven, etc.

Features

- 1200V NPT Trench Technology
- High Speed Switching
- Low Conduction Loss

Block Diagram



NPT Trench IGBT

Ordering Information

Part No.	Package	Packing
TSG40N120CE C0	TO-264	25pcs / Tube

Absolute Maximum Rating (T_A=25°C unless otherwise noted)

Parameter		Symbol	Limit	Unit
Collector-Emitter Voltage		V_{CES}	1200	V
Gate-Emitter Voltage		V_{GES}	±20	V
Continuous Current	T_C=25°C	I_C	64	A
	T_C=100°C		40	A
Pulsed Collector Current *		I_{CM}	120	A
Diode Forward Current (T_C=100℃)		I_F	40	A
Diode Pulse Forward Current		I_{FM}	240	A
Max Power Dissipation	T_J=25°C	P_D	208	W
	T_J=100°C		83	
Operating Junction Temperature		T_J	-55 to +150	ºC
Storage Temperature Range		T_{STG}	-55 to +150	°C

* Repetitive rating: Pulse width limited by max. junction temperature

TSG40N120CE

N-Channel IGBT with FRD.

Thermal Performance

Parameter		Symbol	Limit	Unit
Thermal Resistance - Junction to Case	IGBT	$R\Theta_{JC}$	0.6	°C/W
	DIODE		2.2	
Thermal Resistance - Junction to Ambient		$R\Theta_{JA}$	25	

Electrical Specifications (Tc=25°C unless otherwise noted)

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Static						
Collector-Emitter Breakdown Voltage	V_{GE} = 0V, I_C = 1mA	BV_{CES}	1200	--	--	V
Zero Gate Voltage Collector Current	V_{CE} = 1200V, V_{GE} = 0V	I_{CES}	--	--	1	mA
Gate-Emitter Leakage Current	V_{GE} = 20V, V_{CE} = 0V	I_{GES}	--	--	±250	nA
Gate-Emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 40mA	$V_{GE(TH)}$	4.0	6.0	8.0	V
Collector-Emitter Saturation Voltage	V_{GE} = 15V,I_C =40A, T_J=25ºC	$V_{CE(SAT)}$	--	2	2.8	V
	V_{GE} = 15V,I_C =40A, T_J=125ºC	$V_{CE(SAT)}$	--	2.5	--	V
Dynamic						
Input Capacitance	V_{CE} = 30V, V_{GE} = 0V, f = 1.0MHz	C_{IES}	--	5150	--	pF
Output Capacitance		C_{OES}	--	150	--	
Reverse Transfer Capacitance		C_{RES}	--	100	--	
Switching						
Turn-On Delay Time	V_{CC} = 600V, I_C = 40A, R_G = 5Ω, V_{GE} = 15V Inductive Load, T_J=25°C	$t_{d(on)}$	--	41	--	nS
Rise Time		t_r	--	82	--	
Turn-Off Delay Time		$t_{d(off)}$	--	200	--	
Fall Time		t_f	--	85	170	
Turn-On Switching Loss		E_{on}	--	5.8	8.7	mJ
Turn-Off Switching Loss		E_{off}	--	1.5	2.3	
Total Switching Loss		E_{ts}	--	7.3	11	
Turn-On Delay Time	V_{CC} = 600V, I_C = 40A, R_G = 5Ω, V_{GE} = 15V Inductive Load, T_J=125°C	$t_{d(on)}$	--	45	--	nS
Rise Time		t_r	--	76	--	
Turn-Off Delay Time		$t_{d(off)}$	--	212	--	
Fall Time		t_f	--	189	--	
Turn-On Switching Loss		E_{on}	--	5.6	5	mJ
Turn-Off Switching Loss		E_{off}	--	3.3	5	
Total Switching Loss		E_{ts}	--	8.9	13.4	
Total Gate Charge	V_{CC} = 600V, I_C = 40A, V_{GE} = 15V	Q_g	--	210	315	nC
Gate-Emitter Charge		Q_{ge}	--	50	75	
Gate-Collector Charge		Q_{gc}	--	115	173	

Electrical Specifications of the DIODE (Tc=25°C unless otherwise noted)

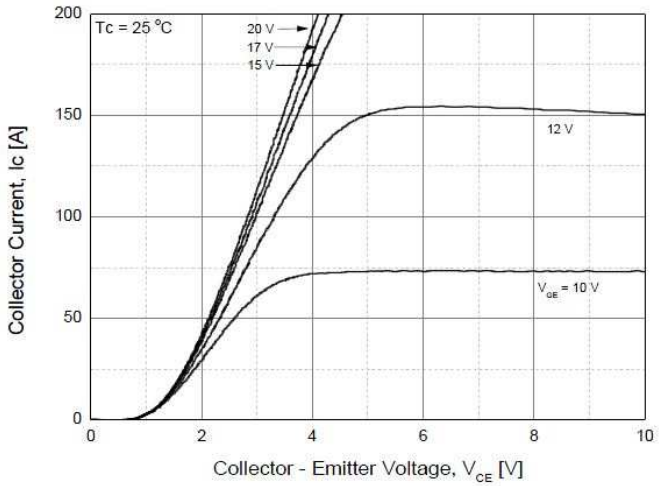
Parameter	Conditions		Symbol	Min	Typ	Max	Unit
Diode Forward Voltage	I_F = 40A,	T_J=25°C	V_{FM}	--	2.8	--	V
		T_J=125°C		--	2.9	--	V
Reverse Recovery Time	I_F = 40A, dI/dt=200A/us	T_J=25°C	t_{fr}	--	220	--	ns
		T_J=125°C		--	3 10	--	
Reverse Recovery Current		T_J=25°C	I_{fr}	--	24	--	A
		T_J=125°C		--	36	--	
Reverse Recovery Charge		T_J=25°C	Q_{fr}	--	2600	--	nC
		T_J=125°C		--	5580	--	

TSG40N120CE

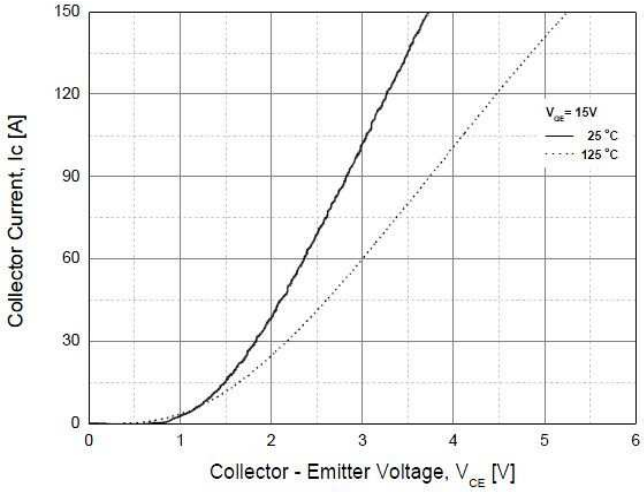
N-Channel IGBT with FRD.

Electrical Characteristics Curve (Tc = 25°C, unless otherwise noted)

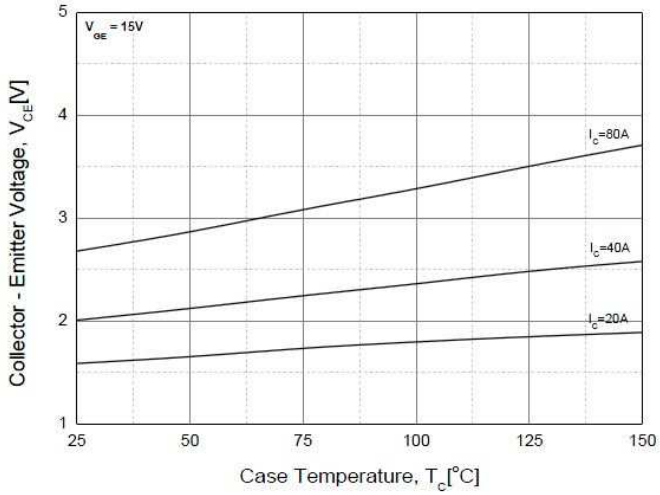
Output Characteristics



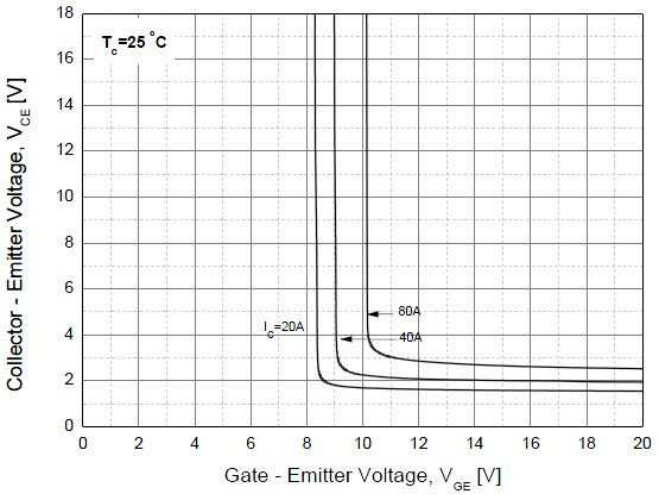
Saturation voltage characteristics



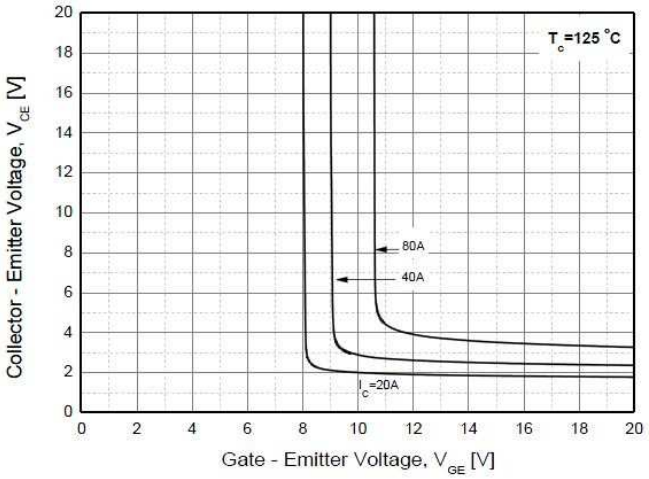
Saturation voltage vs. collector current



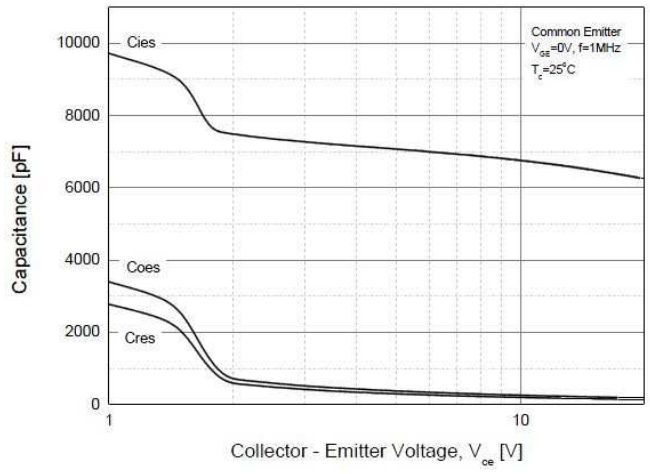
Saturation voltage vs. gate bias



Saturation voltage vs. gate bias



Capacitance characteristics

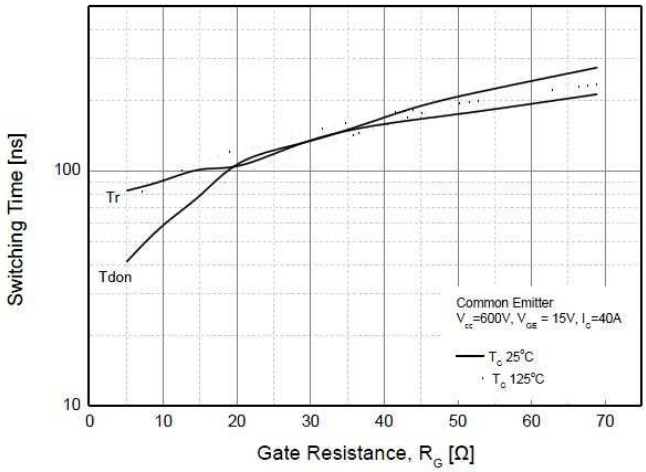


TSG40N120CE

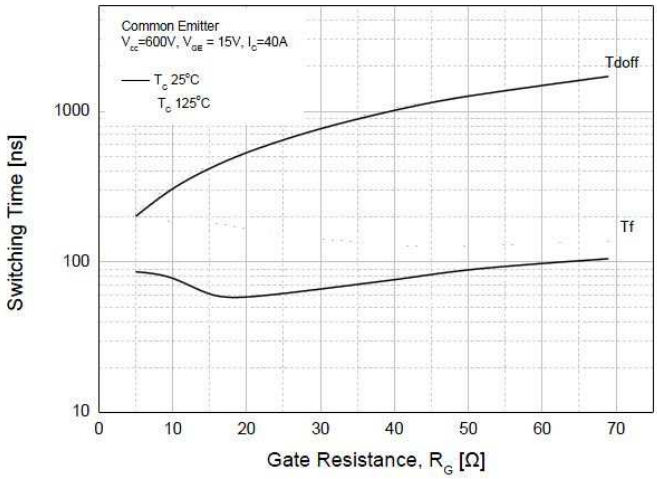
N-Channel IGBT with FRD.

Electrical Characteristics Curve (Ta = 25°C, unless otherwise noted)

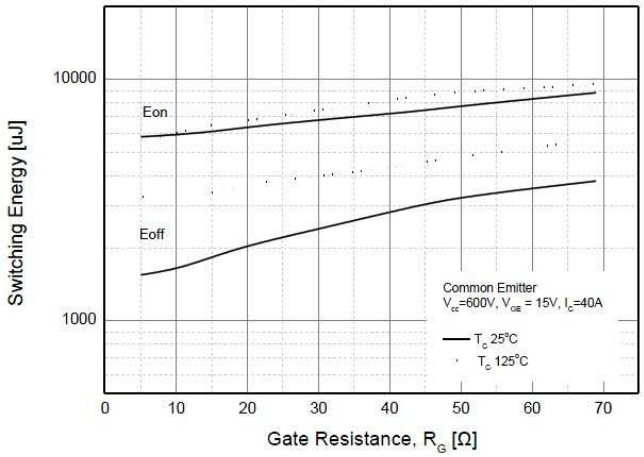
Turn on time vs. gate resistance



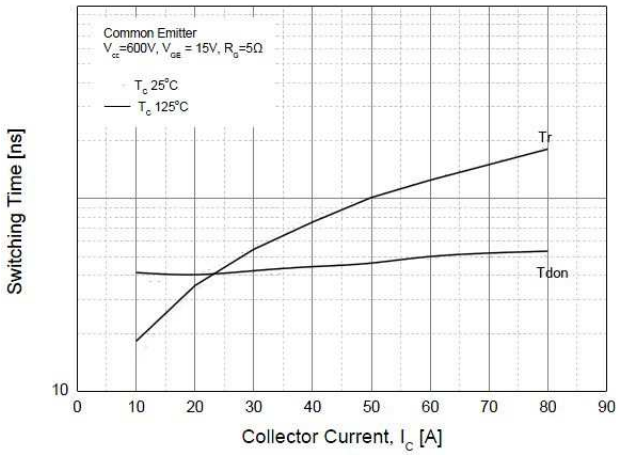
Turn off time vs. gate resistance



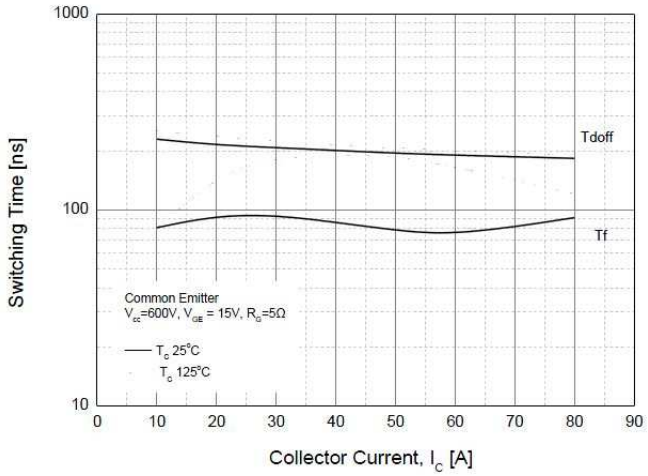
Switching loss vs. gate resistance



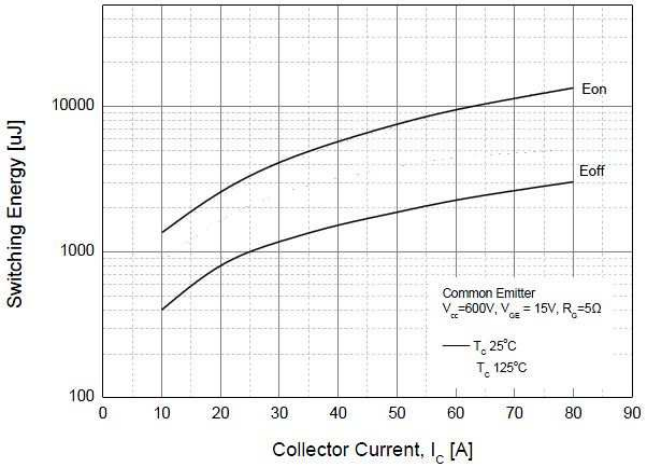
Turn on time vs. collector current



Turn off time vs. collector current



Switching loss vs. collector current

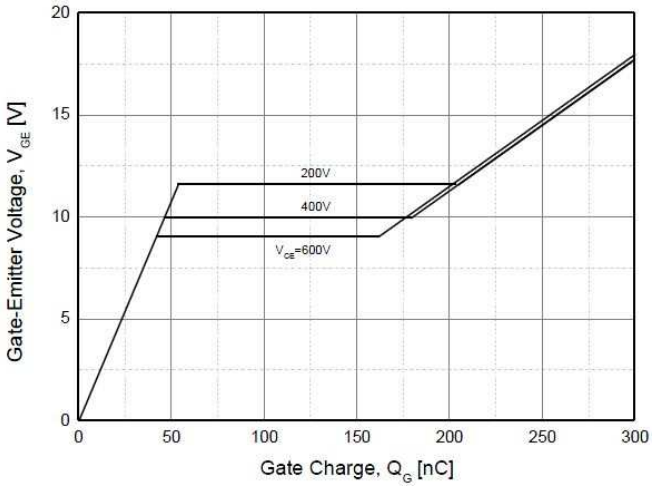


TSG40N120CE

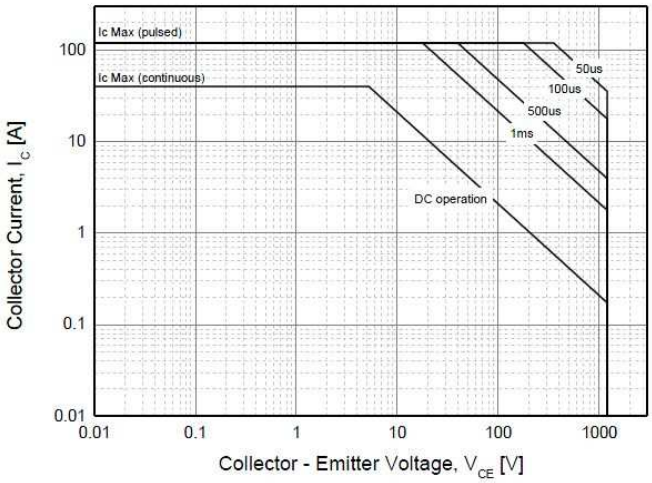
N-Channel IGBT with FRD.

Electrical Characteristics Curve (Tc = 25°C, unless otherwise noted)

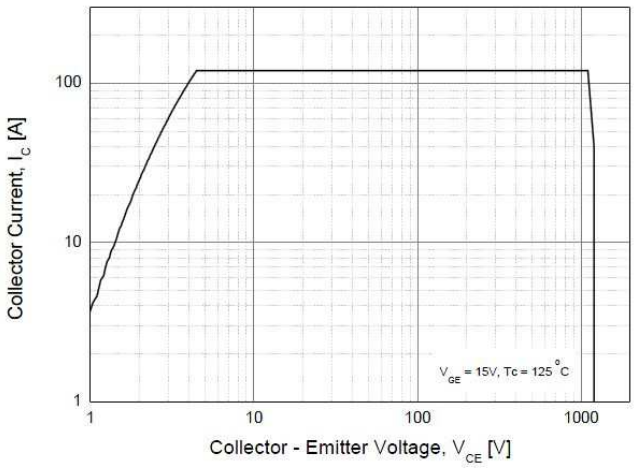
Gate charge characteristics



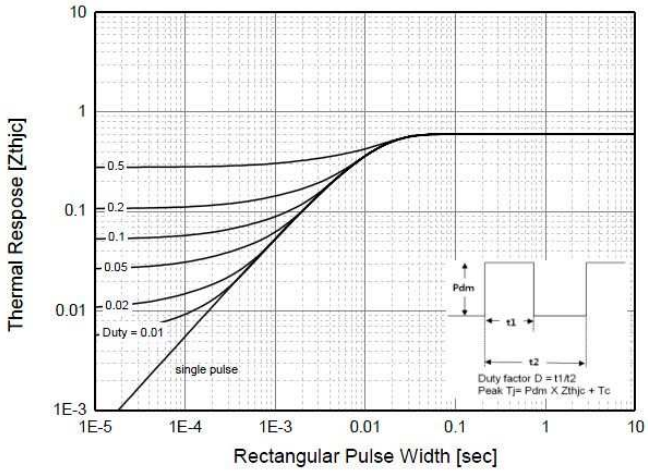
SOA Characteristics



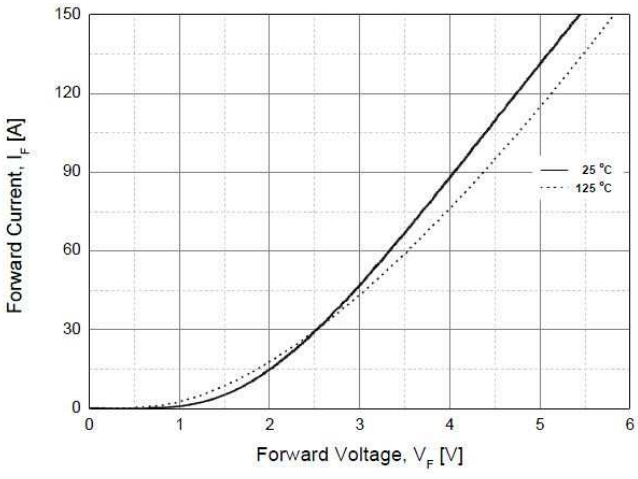
RBSOA



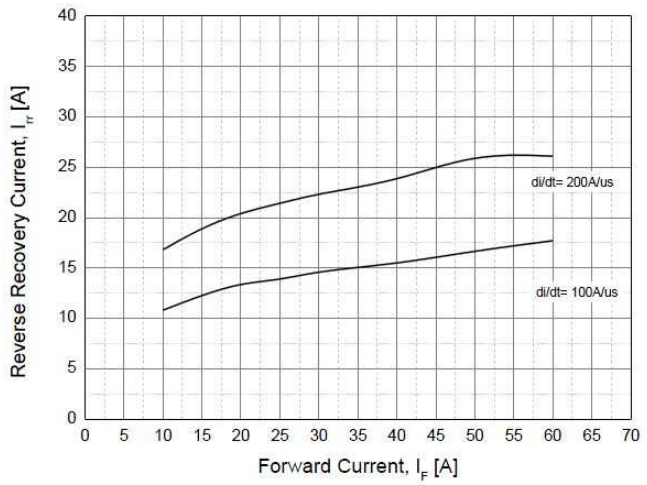
Conduction characteristics



Conduction Characteristics

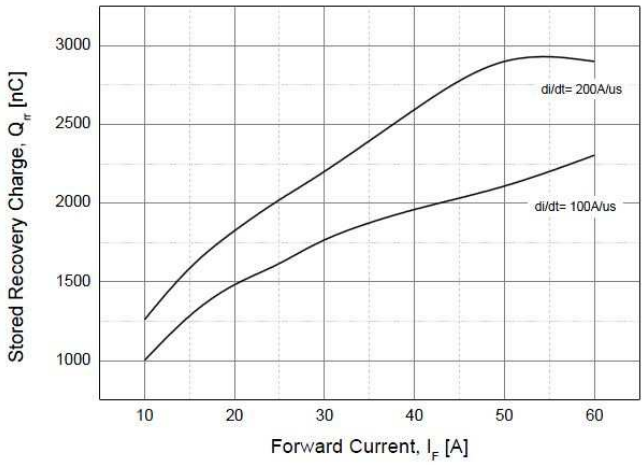


Reverse recovery current vs. forward current

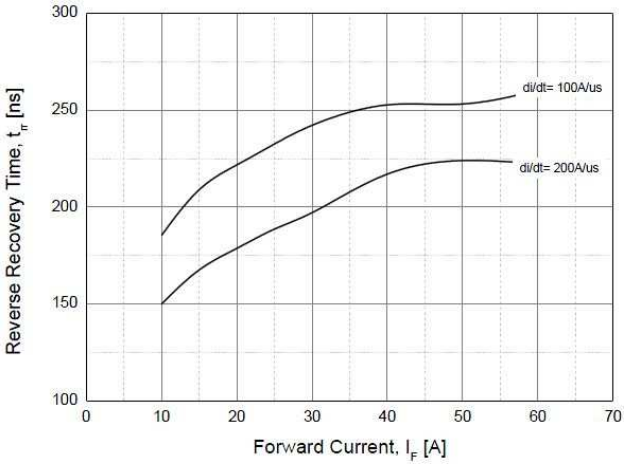


Electrical Characteristics Curve (Tc = 25°C, unless otherwise noted)

Stored recovery charge vs. forward current



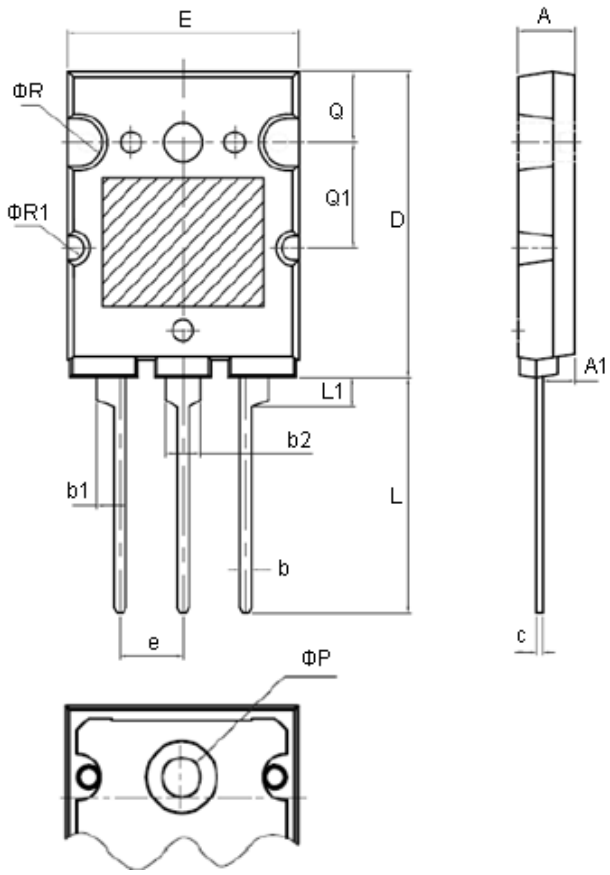
Reverse recovery current vs. forward current



TSG40N120CE

N-Channel IGBT with FRD.

TO-264 Mechanical Drawing



TO-264 DIMENSION						
DIM	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	4.8	5.0	5.2	0.189	0.197	0.205
A1	2.5	2.8	3.1	0.098	0.110	0.122
b	0.90	1.00	1.25	0.035	0.039	0.049
b1	2.3	2.5	2.7	0.091	0.098	0.106
b2	2.8	3.0	3.2	0.110	0.118	0.126
c	0.50	0.60	0.85	0.020	0.024	0.033
D	25.58	26.09	26.59	1.007	1.027	1.047
E	19.30	19.81	20.29	0.760	0.780	0.799
e	5.15	5.45	5.75	0.203	0.215	0.226
L	19.5	20.0	20.5	0.768	0.787	0.807
L1	2.4	2.5	2.6	0.094	0.098	0.102
ΦP	3.10	3.30	3.51	0.122	0.130	0.138
Q	5.8	6.0	6.2	0.228	0.236	0.244
Q1	8.8	9.0	9.2	0.346	0.354	0.362
ΦR	--	2.0	--	--	0.079	--
ΦR1	--	1.0	--	--	0.039	--

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