

NBT6N65S



N-Channel Enhancement Type IGBT With FRD

Voltage:	650	Volts	Current:	6	Ampers	Package:	TO-252
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Features

- NH'S Advanced IGBT Technology
- Low Vcesat For Low On-State Loss
- Very Soft Ultra-Fast Recovery Antiparallel Diode
- High Frequency Operation For High Reliability

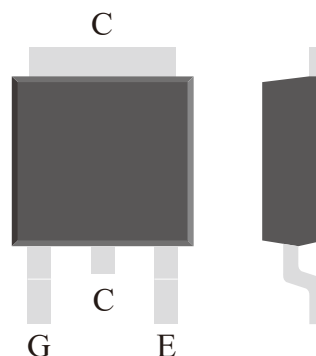
Typical Applications

- Power Factor Correction(PFC)
- Motor Drives
- Uninterruptible Power Supplies(UPS)
- High Frequency Inverters

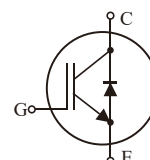
Product Summary

V _{CES} Min.@T _j	650	V
I _C Min.@100℃	6	A
V _{CE(sat)} @25℃	1.8	V

Diagram:



Polarity:



Absolute Maximum Ratings (Ta=25℃ Unless Otherwise Specified)

Parameter	Test Conditions	Symbol	Ratings	Unit
Collector-Emitter Voltage (V _{GS} =0)		V _{CES}	650	V
Gate-Emitter Voltage		V _{GES}	±22	V
Continuous Collector Current (Note 1)	Ta= 25 ℃ Ta= 100 ℃	I _C	12 6	A
Drain Current-Pulse (Note 1)	T _j < 150 ℃	I _{CM}	18	A
Maximum Power Dissipation Power	Ta= 25 ℃	P _D	57	W
Dissipation Derating Factor Above 25℃	Ta= 100 ℃		23	
Derating Factor		D _F	0.45	W/℃
Avalanche Current,Single Pulse (Note 1)	L= 10.0 mH	I _{AS}	9	A
Single Pulse Avalanche Energy (Note 1) Test Circuit & Waveform See Fig.23	L= 10.0 mH IAS= 9.0 A,RG= 10.0 Ω Starting T _j =25 ℃,VG= 15.0 V	E _{AS}	407	mJ

Thermal Characteristics (Ta=25℃ Unless Otherwise Specified)

Parameter	Test Conditions	Symbol	Typ.	Unit
Junction Temperature		T _J	-55 to 150	℃
Storage Temperature Range		T _{STD}	-55 to 150	℃
Thermal Resistance Junction To Ambient With Steady-State	Still Air Environment With Ta=25℃	R _{θJA}	100	℃/W
Thermal Resistance Junction-Case With Steady-State	Device Mounted On 1 in2 FR-4 Board With 2oz. Copper	R _{θJC}	2.2	

Notes: 1.Pulse Width Limited By Max. Junction Temperature. (See Fig. 20).

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Electrical Characteristics (Ta=25°C Unless Otherwise Specified)

Parameter	Test Conditions		Symbol	Min.	Typ.	Max.	Unit
Static Off Characteristics							
Collector To Emitter Voltage	VGE=0V, IC=1mA		BV _{CES}	650	--	--	V
Collector To Emitter Leakage Current	VCE= 650 V, VGE=0V, Tj=25°C		I _{CES}	--	0.1	10	uA
	VCE= 650 V, VGE=0V, Tj=125°C			--	0.2	1	mA
Gate To Emitter Leakage Current	VGE= 20 V, VCE=0V		I _{GES}	--	--	250	nA
Emitter To Gate Leakage Current	VGE= -20 V, VCE=0V		I _{EGS}	--	--	250	nA
Forward Transconductance	IC= 3.0 A, VCE= 15 V		g _{fs}	--	3	--	S
Static On Characteristics							
Gate Threshold Voltage	VGE= VCE, IC=250uA		V _{GE(TH)}	4.5	5.5	6.5	V
Collector-Emitter Saturation Voltage	IC= 3.0 A, VGE= 15.0 V, Tj=25°C		V _{CE(SAT)}	--	1.80	2.25	V
	IC= 3.0 A, VGE= 15.0 V, Tj=125°C			--	1.6	2.1	
Dynamic Characteristics							
Input Capacitance	VCE= 25 V		C _{ies}	--	260	--	pF
Output Capacitance	VGE= 0 V		C _{oes}	--	30	--	pF
Reverse Transfer Capacitance	F= 1 MHZ		C _{res}	--	9	--	pF
Switching Paramters (Test Circuit & Waveform See Fig.21)							
Turn-On Delay Time	VCE= 390 V	Tj=25°C	t _{d(on)}	--	22	--	ns
	IC= 3 A	Tj=150°C		--	24.2	--	
Turn-On Rise Time	VGE= 15.0 V	Tj=25°C	t _r	--	24	--	ns
	RG= 10 Ω	Tj=150°C		--	26.4	--	
Turn-Off Delay Time	Inductive Load	Tj=25°C	t _{d(off)}	--	84	--	ns
		Tj=150°C		--	109.2	--	
Tj=25°C		t _f	--	67	--	ns	
Tj=150°C			--	83.8	--		
Tj=25°C		E _{on}	--	14.0	--	μJ	
Tj=150°C			--	15.4	--		
Tj=25°C		E _{off}	--	39.2	--	μJ	
Tj=150°C			--	49.0	--		
Total Switching Energy		Tj=25°C	E _{tot}	--	53.2	--	μJ
Tj=150°C		--	64.4	--			

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Electrical Characteristics (Ta=25°C Unless Otherwise Specified)

Parameter	Test Conditions		Symbol	Min.	Typ.	Max.	Unit
Gate Charge Paramters (Test Circuit & Waveform See Fig.22)							
Total Gate Charge	VCE= 390 V		Q _g	--	9	--	nC
Gate-Emitter Charge	VGE= 15 V		Q _{ge}	--	3.5	--	nC
Gate-Collector Charge	IC= 3.0 A		Q _{gc}	--	1.2	--	nC
Collector-Emitter Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.24)							
Max. Diode Forward Cuurent	Tj= 25 °C		I _F	--	--	12.0	A
tp Limited by Tj(max)	Tj= 100 °C			--	--	6.0	
Max. Pulsed Forward Cuurent			I _{SM}	--	--	18	A
Diode Forward Voltage	IF= 6.0 A,VGE=-0V		V _F	--	1.45	1.95	V
Reverse Recovery Time	IF= 3.0 A di/dt= 100 A/us	Tj=25°C	t _{rr}	--	21	--	ns
		Tj=175°C		--	23.7	--	
Reverse Recovery Charge	VGE= 0.0 V VCE= 40 V	Tj=25°C	Q _{rr}	--	14	--	nC
		Tj=175°C		--	16.1	--	
Reverse Recovery Current		Tj=25°C	I _{rrm}	--	1.0	--	A
		Tj=175°C		--	1.4	--	
Reverse Recovery Energy		Tj=25°C	E _{rr}	--	0.4	--	μJ
		Tj=175°C		--	0.7	--	

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Typical Characteristics Curves

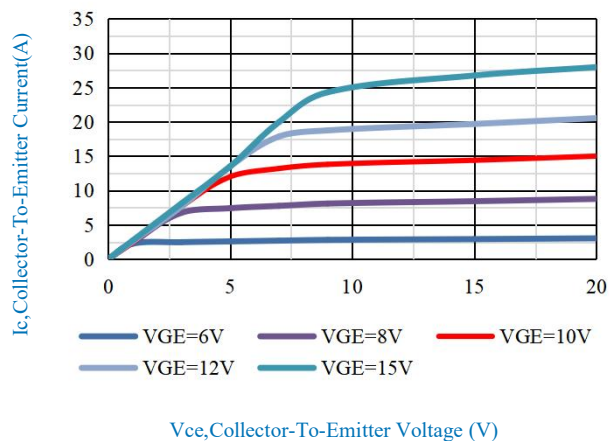


Fig.1-Output Characteristics@ $T_j=25^\circ\text{C}$

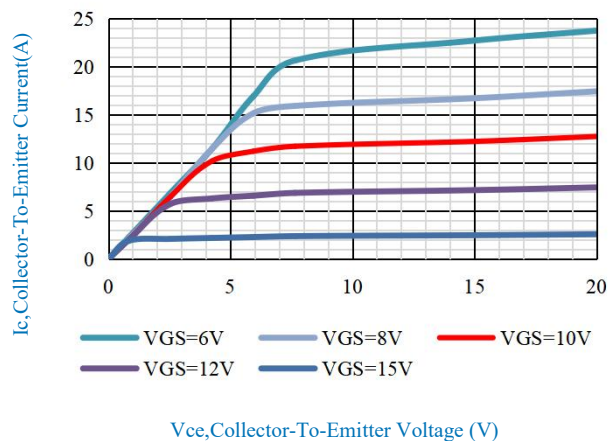


Fig.2-Output Characteristics@ $T_j=150^\circ\text{C}$

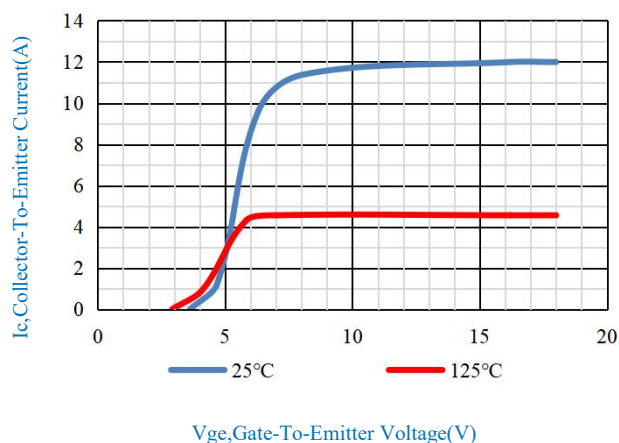


Fig.3-Transfer Characteristics

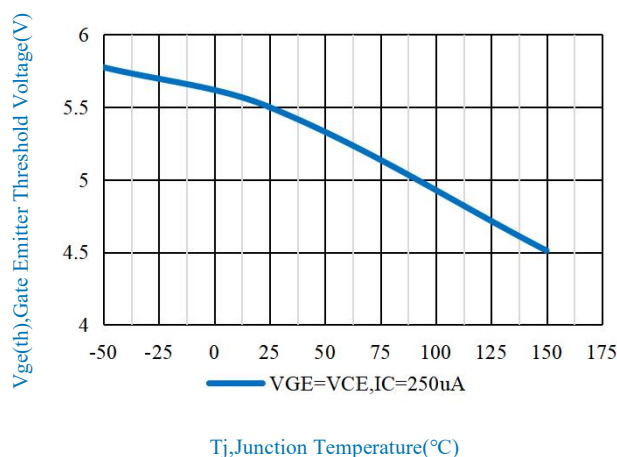


Fig.4-Gate Emitter Threshold Voltage Vs. Junction Temperature

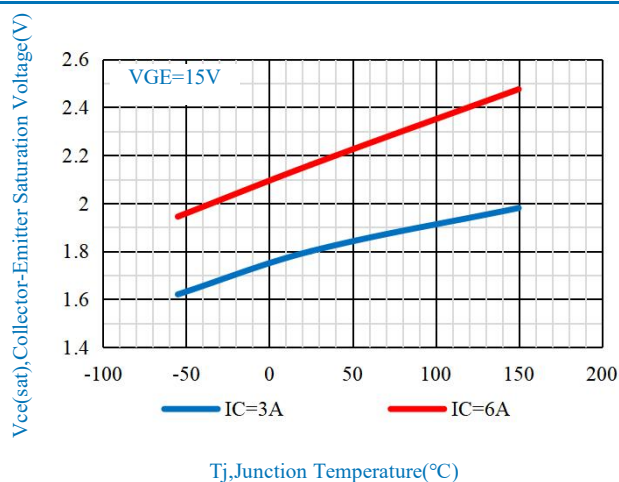


Fig.5-Saturation Voltage vs. Junction Temperature

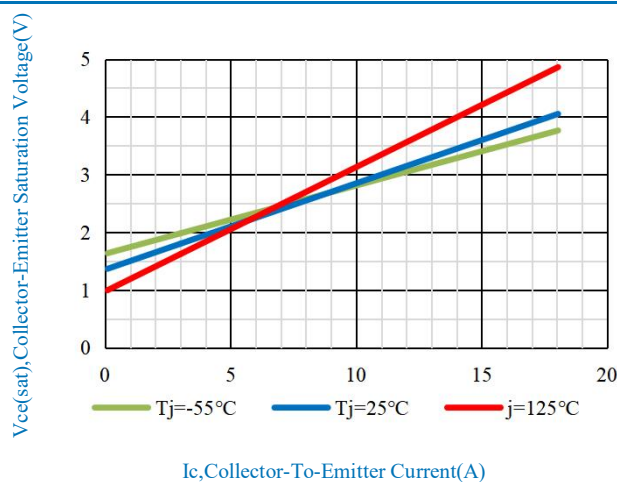


Fig.6-Saturation Voltage vs. Collector-To-Emitter Current

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Typical Characteristics Curves

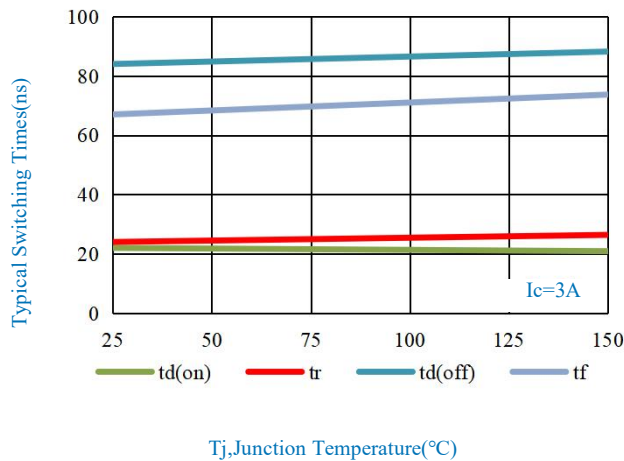


Fig.7-Typical Switching Times Vs. Junction Temperature

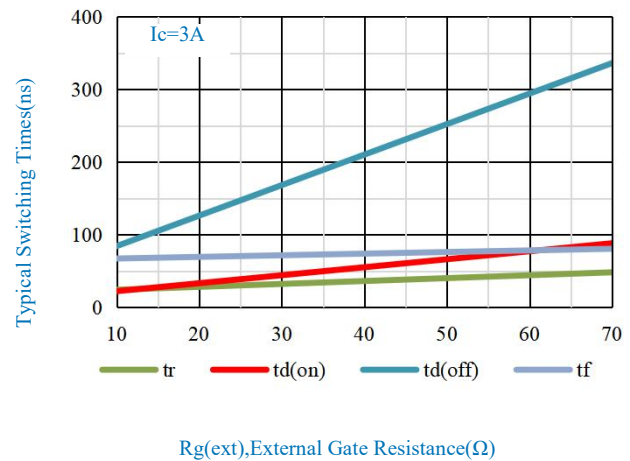


Fig.8-Typical Switching Times Vs. External Gate Resistance

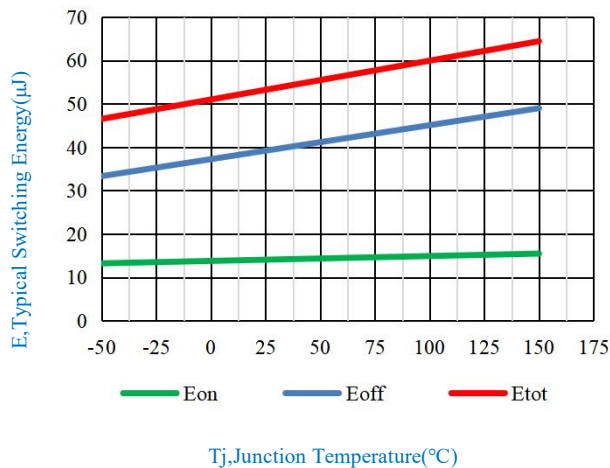


Fig.9-Typical Switching Energy Vs. Junction Temperature

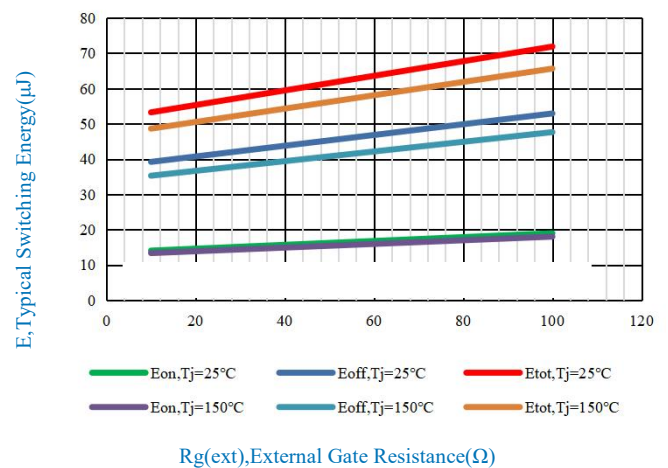


Fig.10-Typical Switching Energy Vs. External Gate Resistance

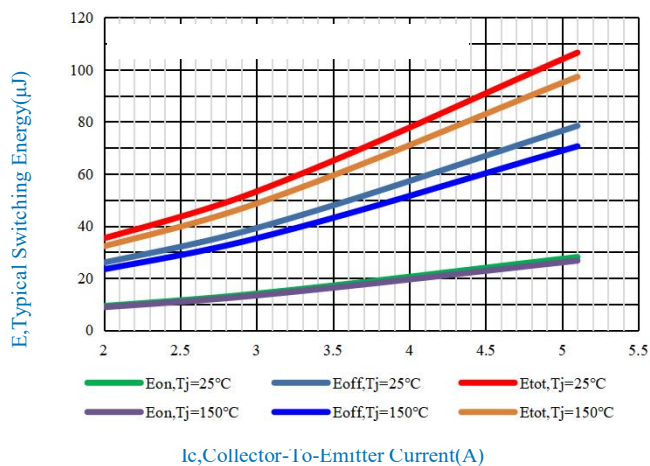


Fig.11-Typical Switching Energy Vs. Collector-To-Emitter Current

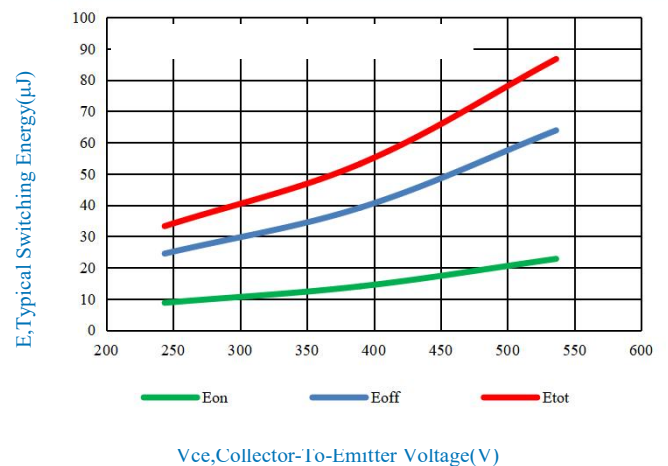


Fig.12-Typical Switching Energy Vs. Collector-To-Emitter Voltage

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Typical Characteristics Curves

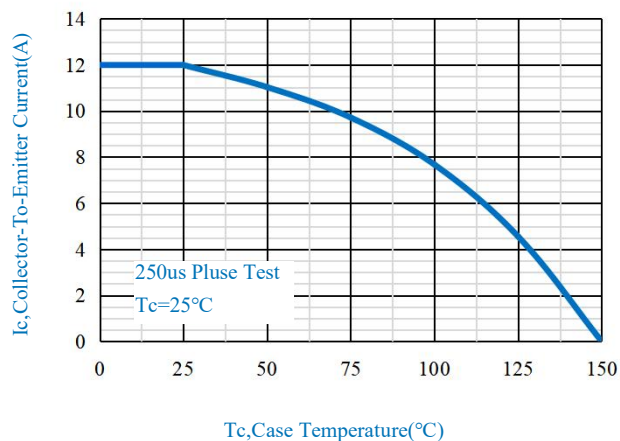


Fig.13-Maximum Continuous Collector Current Vs. Case Temperature

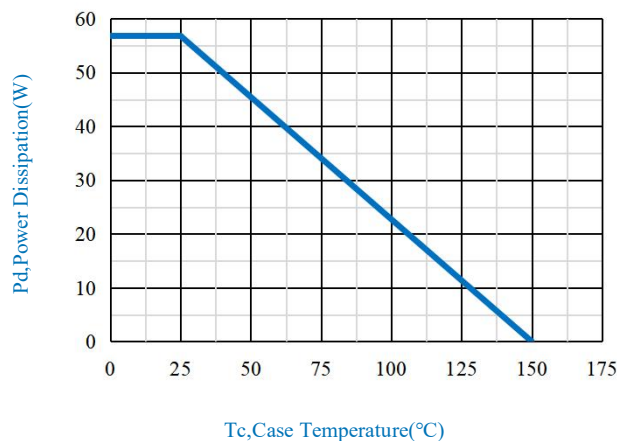


Fig.14-Maximum Power Dissipation Vs. Case Temperature

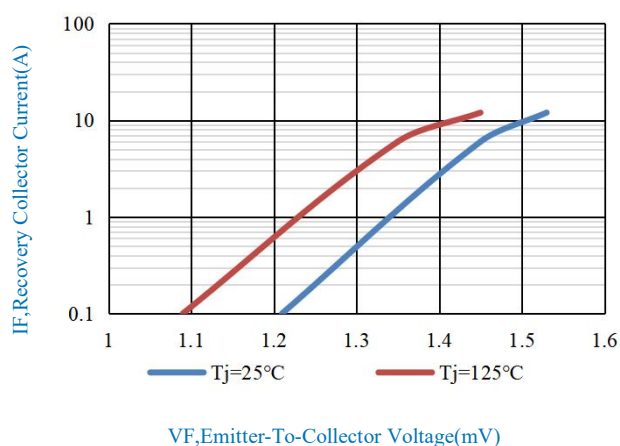


Fig.15-Emitter-To-Collector Diode Forward Voltage

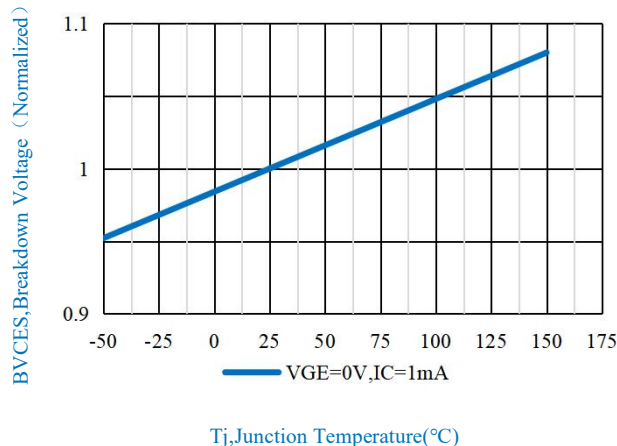


Fig.16-Breakdown Voltage Vs. Junction Temperature

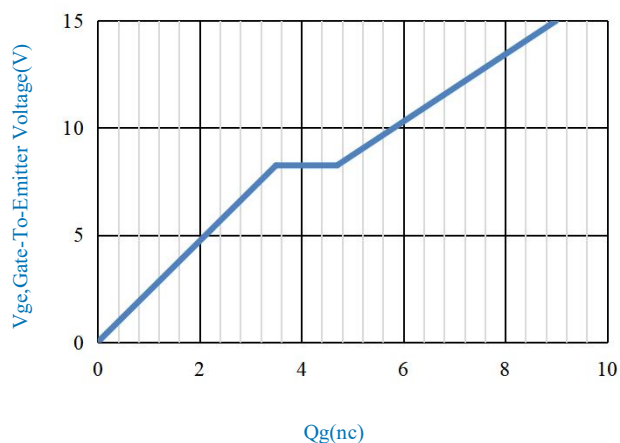


Fig.17-Gate Charge Waveform

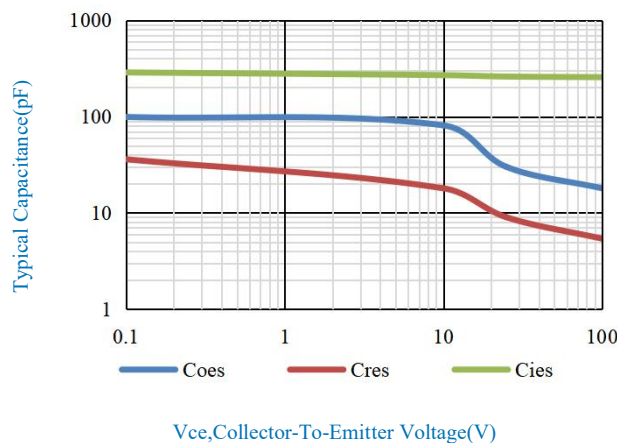


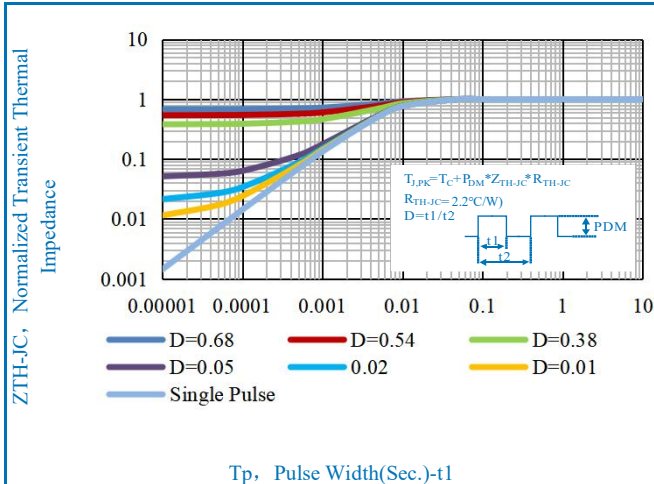
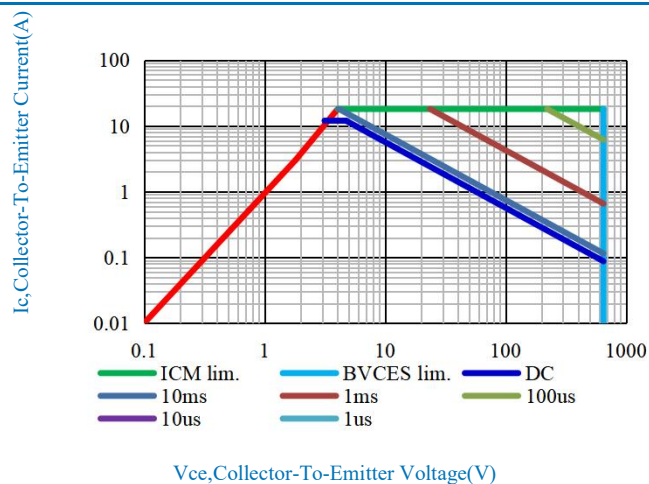
Fig.18-Typical Capacitance Vs. Collector-To-Emitter Voltage

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Typical Characteristics Curves



Test Circuit & Waveform

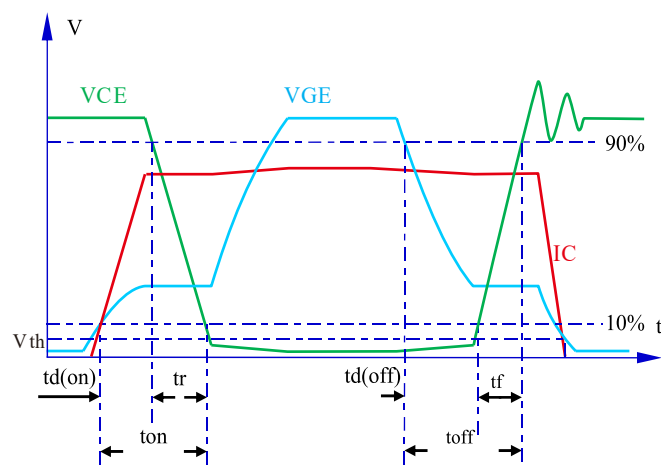
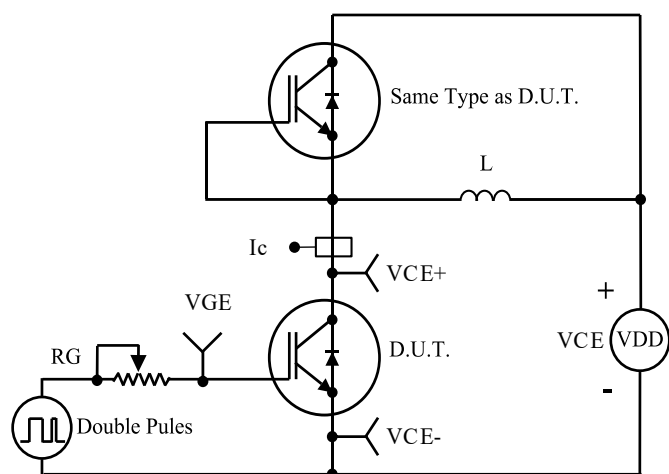


Fig.21- Inductive Switching Test Circuit & Waveform

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Test Circuit & Waveform

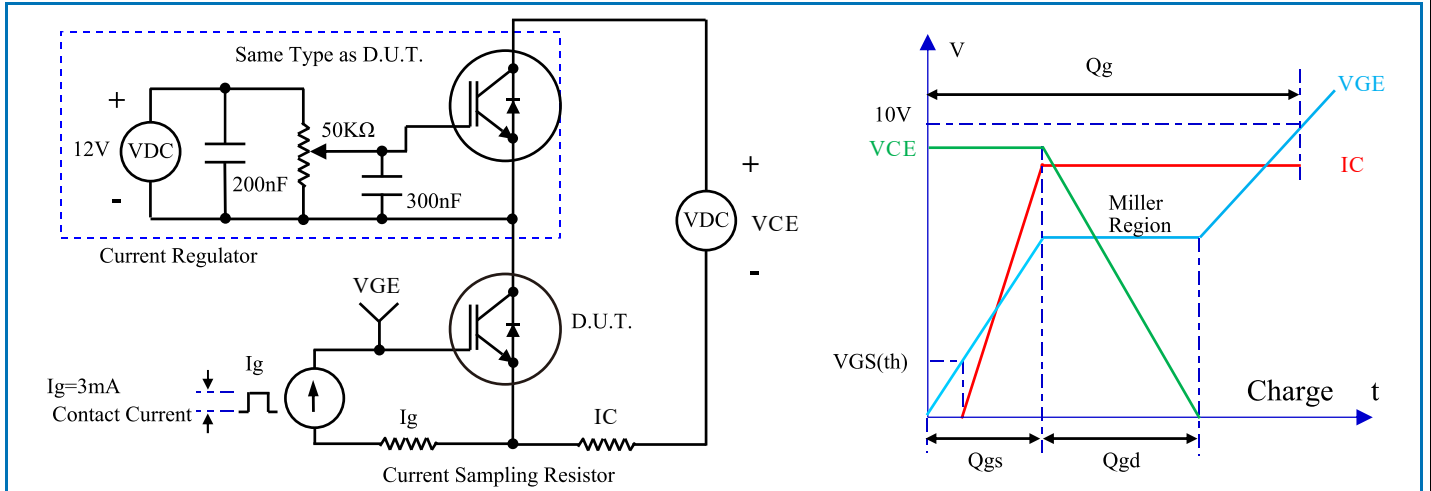


Fig.22- Gate Charge Test Circuit & Waveform

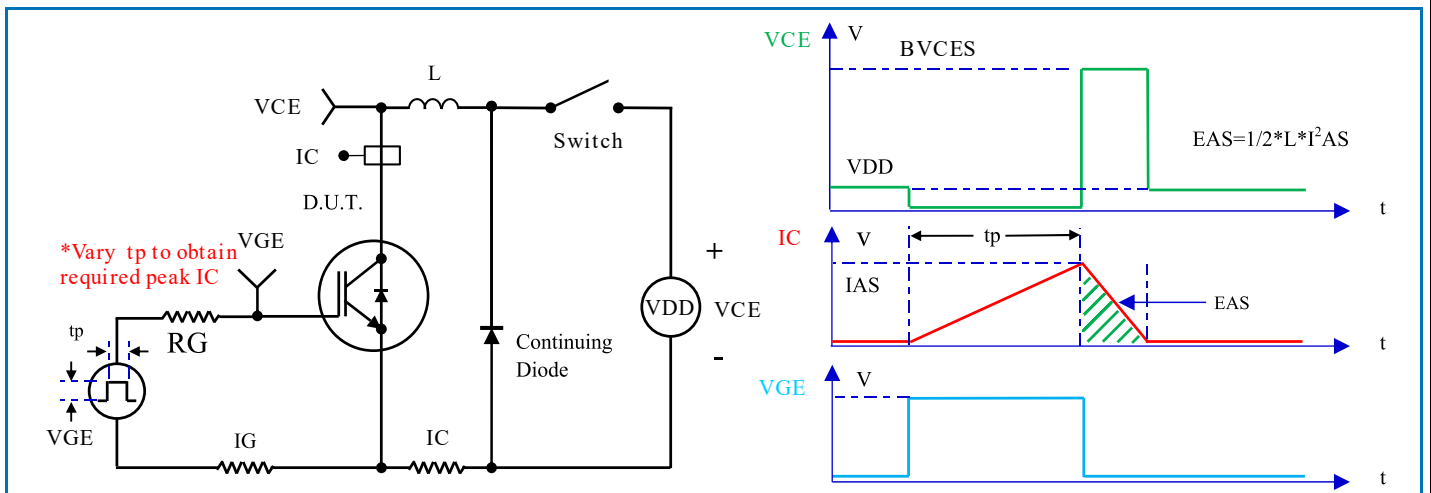


Fig.23- Unclamped Inductive Switching (UIS) Test Circuit & Waveform

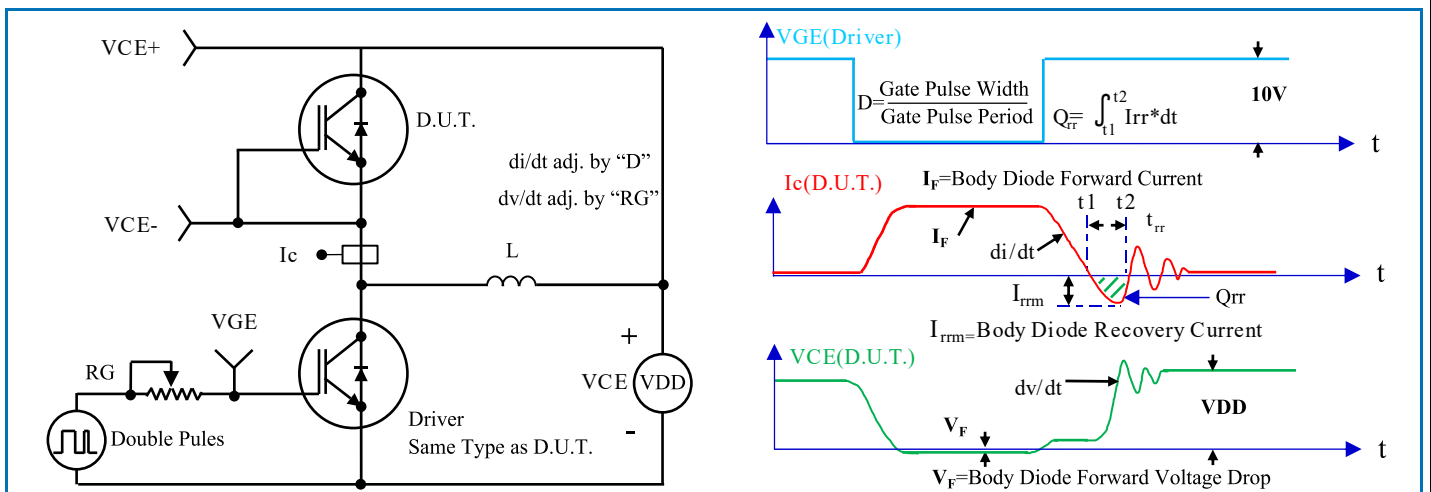


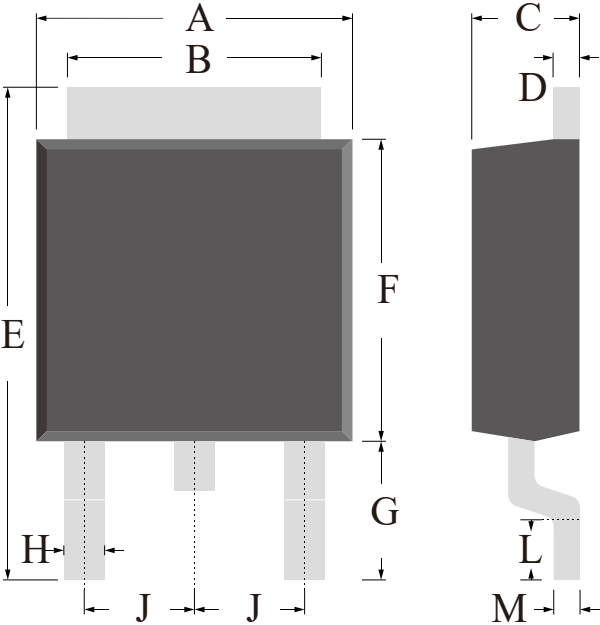
Fig.24- Diode Recovery Test Circuit & Waveform

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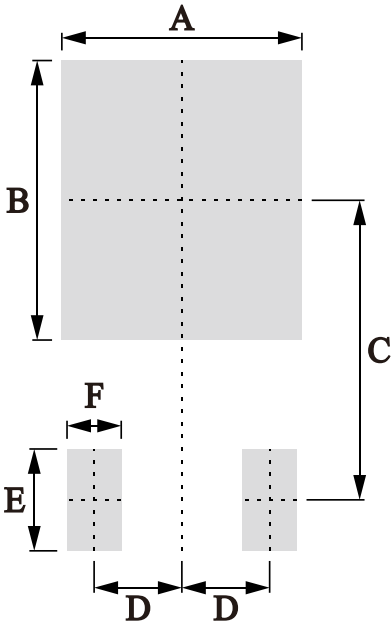
OUTLINE DRAWINGS



TO-252

OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	6.10	-	7.10	0.2402	-	0.2795
B	4.80	-	5.80	0.1890	-	0.2283
C	1.95	-	2.55	0.0768	-	0.1004
D	0.35	-	0.75	0.0138	-	0.0295
E	9.25	-	10.75	0.3642	-	0.4232
F	5.60	-	6.60	0.2205	-	0.2598
G	2.50	-	3.10	0.0984	-	0.1220
H	0.65	-	1.05	0.0256	-	0.0413
J	2.10	-	2.50	0.0827	-	0.0984
L	1.00	-	1.40	0.0394	-	0.0551
M	0.35	-	0.75	0.0138	-	0.0295

RECOMMEDND LAYOUT DRAWINGS



TO-252

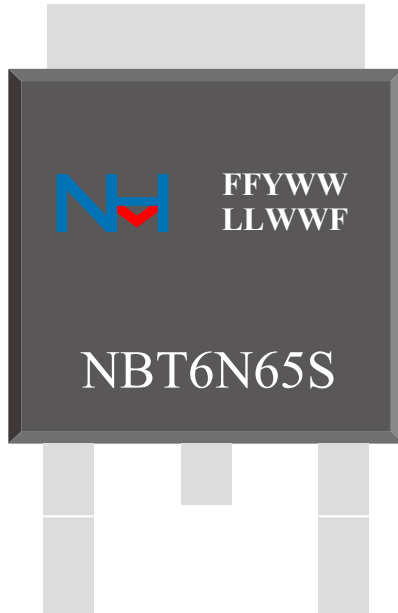
OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	-	6.09	-	-	0.2398	-
B	-	7.57	-	-	0.2980	-
C	-	6.64	-	-	0.2614	-
D	-	2.30	-	-	0.0906	-
E	-	2.76	-	-	0.1087	-
F	-	1.42	-	-	0.0559	-

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MARKING INFORMATION



MARKING INSTRUCTIONS

NH=Niuhang Trademark

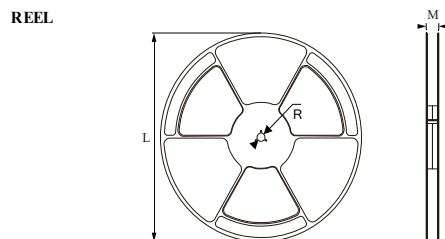
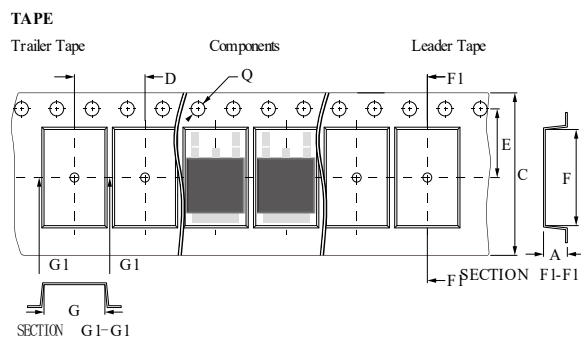
FF=Product Line Code,According To Actual Changes

YWW=Date Code,According To Actual Changes

LLWWF=Internal Code,According To Actual Changes

NBT6N65S=Model

PACKAGING



TO-252

OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
TAPE						
A	2.60	-	2.80	0.1024	-	0.1102
C	15.60	-	16.40	0.6142	-	0.6457
D	7.70	-	8.30	0.3031	-	0.3268
E	7.30	-	7.70	0.2874	-	0.3031
F	10.20	-	10.80	0.4016	-	0.4252
G	6.70	-	7.10	0.2638	-	0.2795
Q Φ	1.40	-	1.60	0.0551	-	0.0630
REEL						
L	328.00	-	332.00	12.913	-	13.071
R	12.00	-	14.00	0.4724	-	0.5512
M	19.40	-	23.40	0.7638	-	0.9213

PACKING INFORMATION

Package Type	Package Code	Product Weight Approx(g/Pcs)	Package Method	Quantity (Pcs/Min. Pack.)	Quantity (Pcs/Inner Box)	Quantity (Pcs/Carton)
TO-252	P1	0.321	13" Reel	2500	5000	30000
TO-252	P2	0.321	13" Reel	2500	2500	25000

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Recommended wave soldering condition

Product	Peak Temperature	Soldering Time
Pb-free devices	260 +0/-5 °C	5 +1/-1 seconds

Recommended temperature profile for IR reflow

	Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
	Average ramp-up rate (TSmax to TP)	3°C/second max.	3°C/second max.
	Preheat-Temperature Min (TS min) -Temperature Max (TS max) -Time(ts min to ts max)	100°C 150°C 60-120 seconds	150°C 200°C 60-180 seconds
	Time maintained above: -Temperature (TL) - Time (tL)	183°C 60-150 seconds	217°C 60-150 seconds
	Peak Temperature(TP)	240 +0/-5 °C	260 +0/-5 °C
	Time within 5°C of actual peak temperature (tp)	10-30 seconds	20-40 seconds
	Ramp down rate	6°C/second max.	6°C/second max.
	Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

Note : All temperatures refer to topside of the package, measured on the package body surface.

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- When the appearance of the product and chip size does not change, in order to product the customer. quality, change the internal structure and the production process Niuhang can not notify

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Specification Revision History

Rev.	Date	Changed Items	Pre-Changed Content	Changed Content
A/1	2025-10-20	First Issue		
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