

To our customers,

Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: <http://www.renesas.com>

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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SILICON POWER TRANSISTOR NTC1865

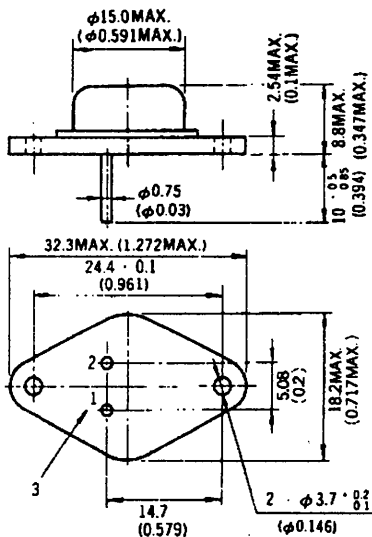
**HIGH SPEED HIGH CURRENT SWITCHING
NPN SILICON TRIPLE DIFFUSED MESA TRANSISTOR**

Industrial Use

DESCRIPTION

Suitable for switching regulator, DC-DC converter and ultrasonic appliance applications.

PACKAGE DIMENSIONS in millimeters (inches)



1. Base
2. Emitter
3. Collector (Case)

EIAJ : TC-16, TB-23
JEDEC: TO-66
IEC : C13

FEATURES

- High speed switching.
- Low collector saturation voltage.
- Specified of reverse biased S.O.A. with inductive loads.

ABSOLUTE MAXIMUM RATINGS

Maximum Voltages and Currents (Ta = 25°C)

Collector to Emitter Voltage	V _{CEX}	500	V
Collector to Emitter Sustaining Voltage	V _{CEX(SUS)}	400	V
Collector to Emitter Sustaining Voltage	V _{CEX(SUS)}	450	V
Emitter to Base Voltage	V _{EBO}	7.0	V
Continuous Collector Current	I _{C(DC)}	7.0	A
Peak Collector Current*	I _{C(pulse)}	15	A
Continuous Base Current	I _{B(DC)}	4.0	A
Peak Base Current*	I _{B(pulse)}	8.0	A

Maximum Power Dissipations

Total Power Dissipation	P _{T(Tc=25°C)}	50	W
Total Power Dissipation	P _{T(Tc=100°C)}	29	W
Total Power Dissipation	P _{T(Ta=25°C)}	2.0	W

Maximum Temperatures

Junction Temperature	T _j	200	°C
Storage Temperature	T _{stg}	-65 to +200	°C
Lead Temperature 1/8 inch from case for 10 seconds	T _L	260	°C

Thermal Resistances

Junction to Case	R _{th(j-c)}	3.50	°C/W
Junction to Ambient	R _{th(j-a)}	87.5	°C/W

* Pulsed PW ≤ 300 μs, duty cycle ≤ 10%

ELECTRICAL CHARACTERISTICS (Ta = 25°C unless otherwise noted)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Collector to Emitter Sustaining Voltage	V _{CEO(SUS)}	400			V	Table 1. I _C = 5A, I _{B1} = 1A, L = 100μH
	V _{CEX(S)}	450			V	Table 1. I _C = 5A, I _{B1} = -I _{B2} = 1A V _{clamp} = Rated V _{CEX} , Ta = 125°C
	V _{CEX(SUS)2}	400			V	Table 1. I _C = 10A, I _{B1} = 2A, I _{B2} = -1A, V _{clamp} = Rated V _{CEX} , Ta = 125°C
Collector Cutoff Current	I _{CER}			1.0	mA	V _{CE} = 500V, R _{BE} = 50Ω, Ta = 125°C
	I _{CEX}			100	μA	V _{CE} = 500V, V _{BE(OFF)} = -1.5V
	I _{CEX}			500	μA	V _{CE} = 500V, V _{BE(OFF)} = -1.5V, Ta = 125°C
Emitter Cutoff Current	I _{EBO}			10	μA	V _{EB} = 7.0V, I _C = 0
Second Breakdown Collector Current	I _{S/B}	1			A	t = 1.0 s, V _{CE} = 40V, T _c = 25°C
Second Breakdown Energy	E _{S/B}	500			μJ	I _C = 5A, I _{B1} = 1A, V _{BE(OFF)} = -5V
DC Current Gain	h _{FE1}	15		100		V _{CE} = 5V, I _C = 3A **
	h _{FE2}	10				V _{CE} = 5V, I _C = 5A **
Collector Saturation Voltage	V _{CE(sat)}			1.0	V	I _C = 5A, I _B = 1A **
	V _{CE(sat)}			1.5	V	I _C = 5A, I _B = 1A, Ta = 125°C **
Base Saturation Voltage	V _{BE(sat)}			1.5	V	I _C = 5A, I _B = 1A **
	V _{BE(sat)}			1.5	V	I _C = 5A, I _B = 1A, Ta = 125°C **
Gain Bandwidth Product	f _T	10			MHz	V _{CE} = 10V, I _C = 300mA, f _o = 3.0 MHz, T _c = 25°C
Output Capacitance	C _{ob}			200	pF	V _{CB} = 10V, f _o = 1.0 MHz
Delay Time	t _d			0.1	μs	Resistive Load (Table 1.)
Rise Time	t _r			0.9	μs	
	t _r			2.7	μs	
Storage Time	t _{stg}			2.0	μs	Ta = 125°C I _C = 5A, I _{B1} = -I _{B2} = 1A
	t _{stg}			4.0	μs	R _L = 30Ω, V _{CC} ≈ 150V
Fall Time	t _f			0.7	μs	Ta = 125°C PW ≈ 50μs, duty cycle ≤ 2%
	t _f			2.8	μs	Ta = 125°C

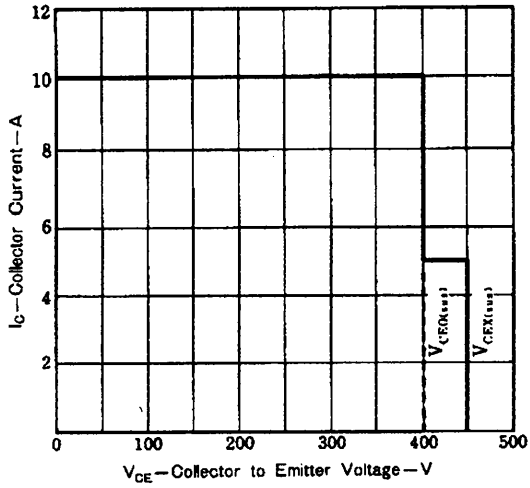
** PW ≤ 350 μs, duty cycle ≤ 2%

TABLE 1. - TEST CONDITIONS FOR DYNAMIC PERFORMANCE

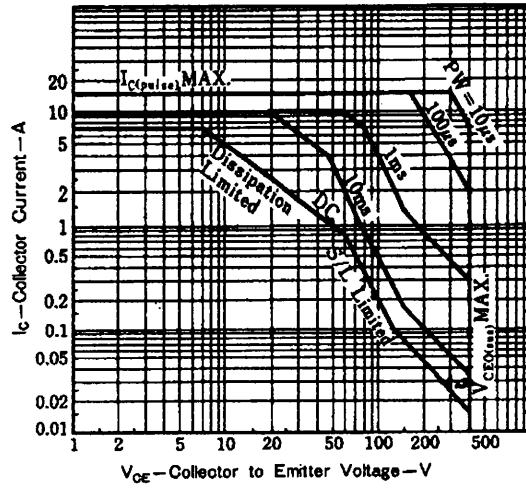
	V _{CEO} (SUS)	V _{CEX} (SUS)	E _{S/B}	RESISTIVE SWITCHING
INPUT CONDITIONS	<p>PW Varied to Attain I_C = 5A</p>	<p>PW Varied to Attain I_C = 5A duty cycle ≤ 2% Q₁ = 2SA959</p>		
CIRCUIT VALUES	L _{coil} = 100μH, V _{CC} = 10V R _{coil} = 0.05Ω V _{clamp} (Unclamped)	L _{coil} = 180μH, V _{CC} = 20V R _{coil} = 0.05Ω V _{clamp} = Rated V _{CEX} Value	L _{coil} = 40μH, V _{CC} = 10V R _{coil} = 0.05Ω, R _{BB2} = 50Ω V _{clamp} (Unclamped)	R _L = 30Ω, V _{CC} ≈ 150V
TEST CIRCUITS	<p>INDUCTIVE TEST CIRCUIT</p> <p>D1 = F114F D2 = 6FH4S</p>	<p>OUTPUT WAVEFORM</p> <p>t₁ Adjust to Obtain I_C</p> $t_1 = \frac{L_{coil} (I_C \text{ pk})}{V_{CC}}$ $t_2 = \frac{L_{coil} (I_C \text{ pk})}{V_{clamp}}$	<p>RESISTIVE TEST CIRCUIT</p>	

TYPICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$)

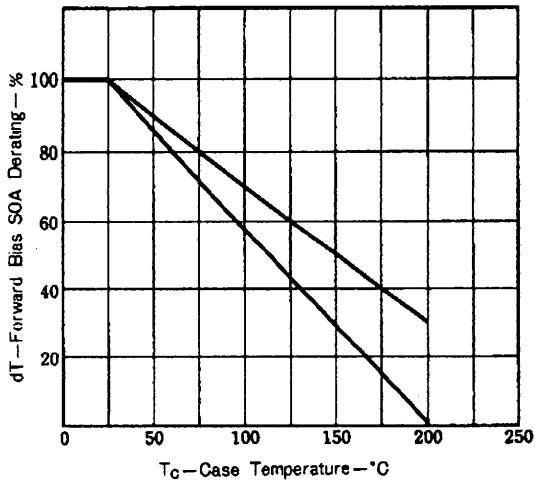
REVERSE BIAS SAFE OPERATING AREA



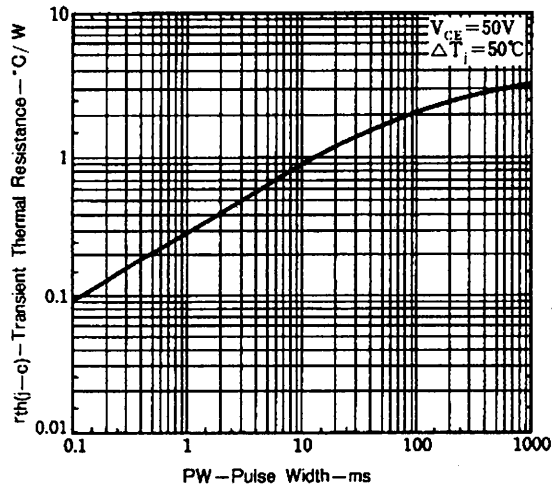
FORWARD BIAS SAFE OPERATING AREAS



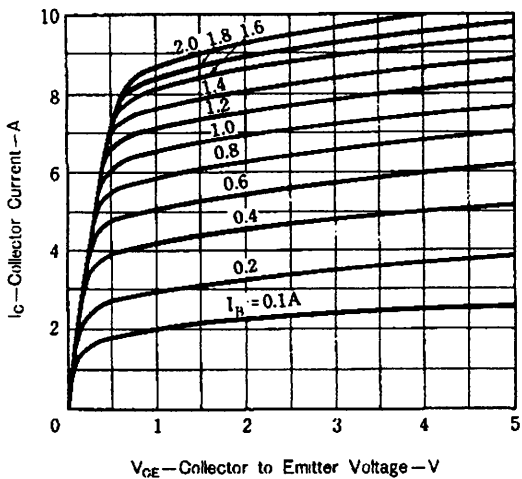
DERATING CURVE OF FORWARD BIAS SAFE OPERATING AREA



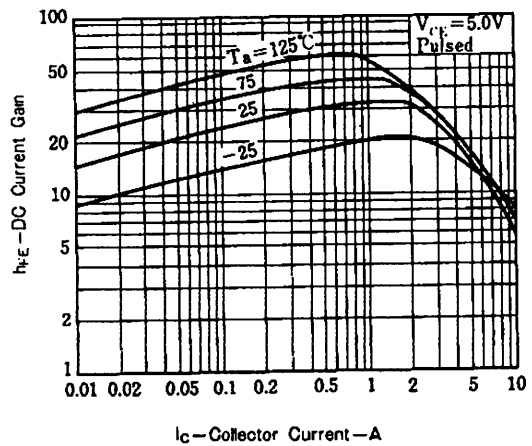
TRANSIENT THERMAL RESISTANCE



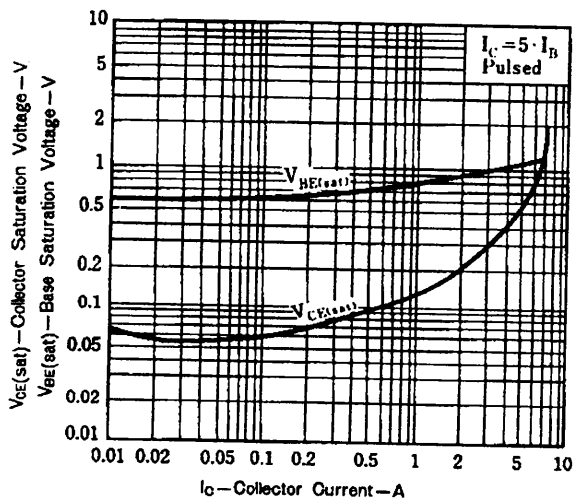
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



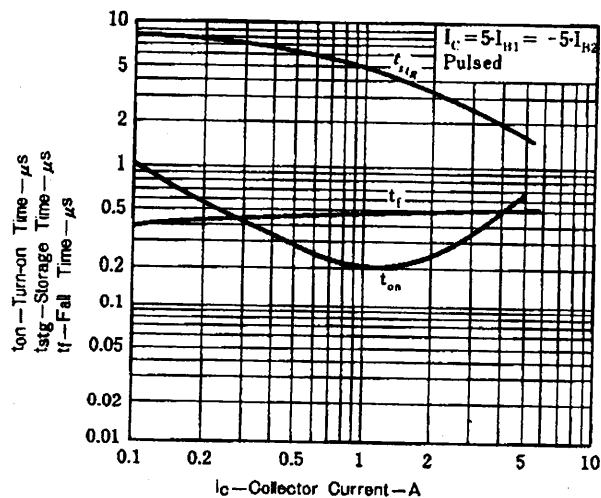
DC CURRENT GAIN vs. COLLECTOR CURRENT



BASE AND COLLECTOR SATURATION VOLTAGE vs. COLLECTOR CURRENT



TURN ON TIME, STORAGE TIME AND FALL TIME vs. COLLECTOR CURRENT



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