

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 NTA959

HIGH SPEED HIGH CURRENT SWITCHING PNP EPITAXIAL TRANSISTOR

Industrial Use

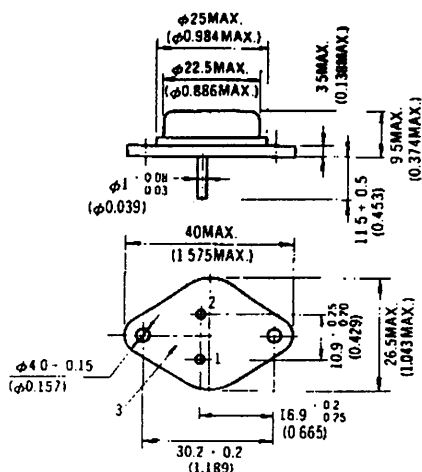
DESCRIPTION

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

FEATURES

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

PACKAGE DIMENSIONS in millimeters (inches)



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

EIAJ : TC-3, TB-3

JEDEC: TO-3

IEC : C14A, B18

ABSOLUTE MAXIMUM RATINGS

Maximum Voltages and Currents ($T_a = 25^\circ\text{C}$)

Collector to Emitter Voltage	V_{CEX}	-100	V
Collector to Emitter Sustaining Voltage	$V_{CE0(SUS)}$	-100	V
Collector to Emitter Sustaining Voltage	$V_{CEX(SUS)}$	-100	V
Emitter to Base Voltage	V_{EBO}	-7.0	V
Continuous Collector Current	$I_C(DC)$	-15	A
Peak Collector Current*	$I_C(pulse)$	-30	A
Continuous Base Current	$I_B(DC)$	-5.0	A
Peak Base Current*	$I_B(pulse)$	-10	A

Maximum Power Dissipations

Total Power Dissipation	$P_T(T_c=25^\circ\text{C})$	150	W
Total Power Dissipation	$P_T(T_c=100^\circ\text{C})$	86	W
Total Power Dissipation	$P_T(T_a=25^\circ\text{C})$	5	W

Maximum Temperatures

Junction Temperature	T_j	200	$^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +200	$^\circ\text{C}$
Lead Temperature 1/8 inch from case for 10 seconds	T_L	260	$^\circ\text{C}$

Thermal Resistances

Junction to Case	$R_{th(j-c)}$	1.17	$^\circ\text{C/W}$
Junction to Ambient	$R_{th(j-a)}$	35	$^\circ\text{C/W}$

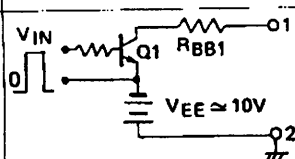
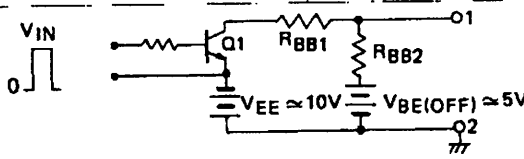
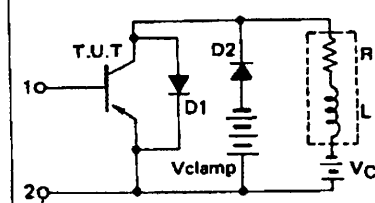
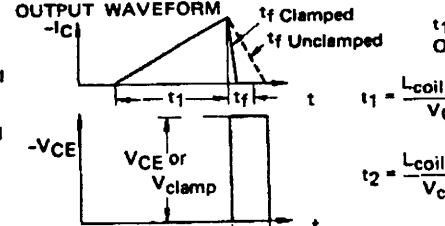
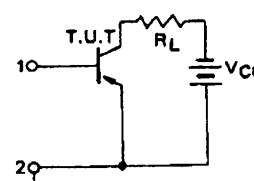
* Pulsed $PW \leq 300 \mu\text{s}$, duty cycle $\leq 10\%$

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$ unless otherwise noted)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Collector to Emitter Sustaining Voltage	$V_{CEO(SUS)}$	-100			V	Table 1. $I_C = -10\text{A}$, $I_{B1} = -1.0\text{A}$, $L = 50\text{ }\mu\text{H}$
	$V_{CEX(SUS)1}$	-100			V	Table 1. $I_C = -10\text{A}$, $I_{B1} = -I_{B2} = -1.0\text{A}$ $V_{clamp} = \text{Rated } V_{CEX}$, $T_a = 125^\circ\text{C}$
	$V_{CEX(SUS)2}$	-100			V	Table 1. $I_C = -20\text{A}$, $I_{B1} = -2\text{A}$, $I_{B2} = -1.0\text{A}$ $V_{clamp} = \text{Rated } V_{CEX}$, $T_a = 125^\circ\text{C}$
Collector Cutoff Current	I_{CER}			-2.0	mA	$V_{CE} = -100\text{V}$, $R_{BE} = 50\Omega$, $T_a = 125^\circ\text{C}$
	I_{CEX}			-100	μA	$V_{CE} = -100\text{V}$, $V_{BE(OFF)} = 1.5\text{V}$
	I_{CEX}			-1.0	mA	$V_{CE} = -100\text{V}$, $V_{BE(OFF)} = 1.5\text{V}$ $T_a = 125^\circ\text{C}$
Emitter Cutoff Current	I_{EBO}			-10	μA	$V_{EB} = -7.0\text{V}$, $I_C = 0$
Second Breakdown Collector Current	$I_{S/B}$	-7.5			A	$t = 1.0\text{ s}$, $V_{CE} = -20\text{V}$, $T_c = 25^\circ\text{C}$
Second Breakdown Energy	$E_{S/B}$	2.0			mJ	$I_C = -10\text{A}$, $I_{B1} = -1\text{A}$, $V_{BE(OFF)} = 5\text{V}$
DC Current Gain	h_{FE1}	30		200		$V_{CE} = -5\text{V}$, $I_C = -5\text{A}$ **
	h_{FE2}	20				$V_{CE} = -5\text{V}$, $I_C = -10\text{A}$ **
Collector Saturation Voltage	$V_{CE(sat)}$			-1.0	V	$I_C = -10\text{A}$, $I_B = -1.0\text{A}$ **
	$V_{CE(sat)}$			-1.5	V	$I_C = -10\text{A}$, $I_B = -1.0\text{A}$, $T_a = 125^\circ\text{C}$ **
Base Saturation Voltage	$V_{BE(sat)}$			-1.5	V	$I_C = -10\text{A}$, $I_B = -1.0\text{A}$ **
	$V_{BE(sat)}$			-1.5	V	$I_C = -10\text{A}$, $I_B = -1.0\text{A}$, $T_a = 125^\circ\text{C}$ **
Gain Bandwidth Product	f_T	20			MHz	$V_{CE} = -10\text{V}$, $I_C = -500\text{mA}$, $f_o = 3.0\text{MHz}$, $T_c = 25^\circ\text{C}$
Output Capacitance	C_{ob}			500	pF	$V_{CB} = -10\text{V}$, $f_o = 1.0\text{ MHz}$
Delay Time	t_d			0.1	μs	Resistive Load (Table 1.)
Rise Time	t_r			0.7	μs	
	t_r			2.1	μs	$T_a = 125^\circ\text{C}$ $I_C = -10\text{A}$, $I_{B1} = -I_{B2} = -1.0\text{A}$
Storage Time	t_{stg}			1.5	μs	$R_L = 5.0\Omega$, $V_{CC} \approx -50\text{V}$
	t_{stg}			3.0	μs	$T_a = 125^\circ\text{C}$ $PW \approx 50\mu\text{s}$, duty cycle $\leq 2\%$
Fall Time	t_f			0.3	μs	
	t_f			1.2	μs	$T_a = 125^\circ\text{C}$

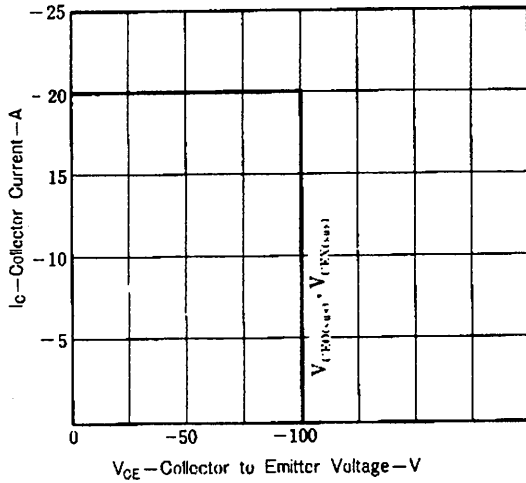
** $PW \leq 350\text{ }\mu\text{s}$, duty cycle $\leq 2\%$

TABLE 1. — TEST CONDITIONS FOR DYNAMIC PERFORMANCE

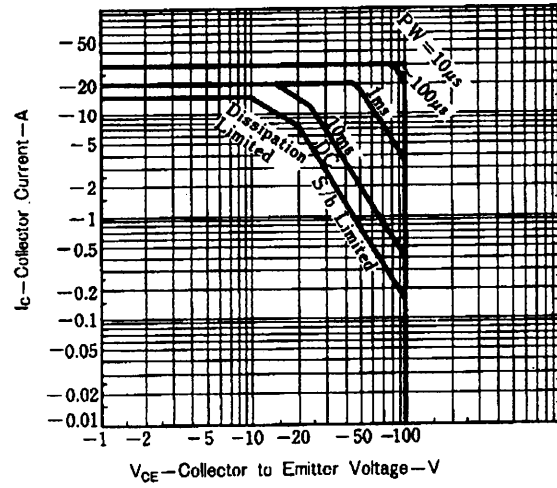
	$V_{CEO} \text{ (SUS)}$	$V_{CEX} \text{ (SUS)}$	E_S/B	RESISTIVE SWITCHING
INPUT CONDITIONS	 PW Varied to Attain $I_C = -10A$	 PW Varied to Attain $I_C = -10A$ duty cycle $\leq 2\%$ $Q_1 = 2SC1869$		
CIRCUIT VALUES	$L_{coil} = 50\mu H, V_{CC} = -10V$ $R_{coil} = 0.05\Omega$ V_{clamp} (Unclamped)	$L_{coil} = 180\mu H, V_{CC} = -20V$ $R_{coil} = 0.2\Omega$ $V_{clamp} = \text{Rated } V_{CEX} \text{ Value}$	$L_{coil} = 40\mu H, V_{CC} = -10V$ $R_{coil} = 0.05\Omega, R_{BB2} = 50\Omega$ V_{clamp} (Unclamped)	$R_L = 5.5\Omega, V_{CC} \approx -50V$
TEST CIRCUITS	INDUCTIVE TEST CIRCUIT  $D1 = F114F$ $D2 = 6FH4S$	OUTPUT WAVEFORM  $t_1 = \frac{L_{coil} (I_C \text{ pk})}{V_{CC}}$ $t_2 = \frac{L_{coil} (I_C \text{ pk})}{V_{clamp}}$	RESISTIVE TEST CIRCUIT 	

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

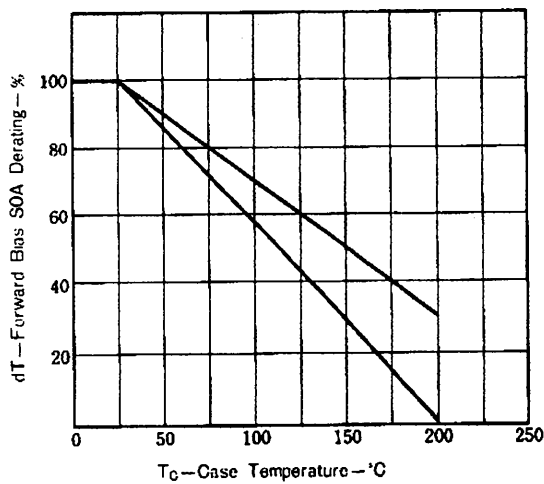
REVERSE BIAS SAFE OPERATING AREA



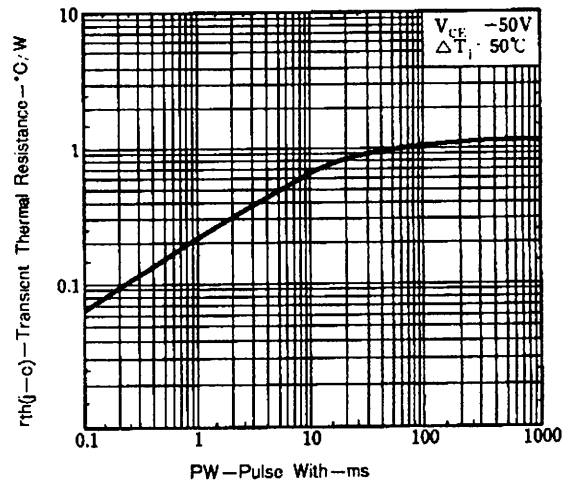
FORWARD BIAS SAFE OPERATING AREAS



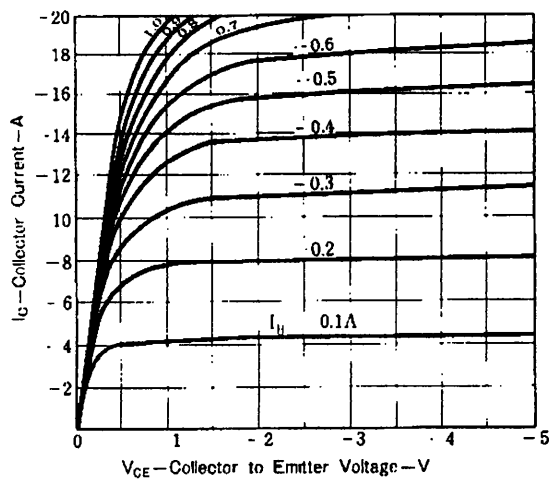
DERATING CURVE OF FORWARD BIAS SAFE OPERATING AREA



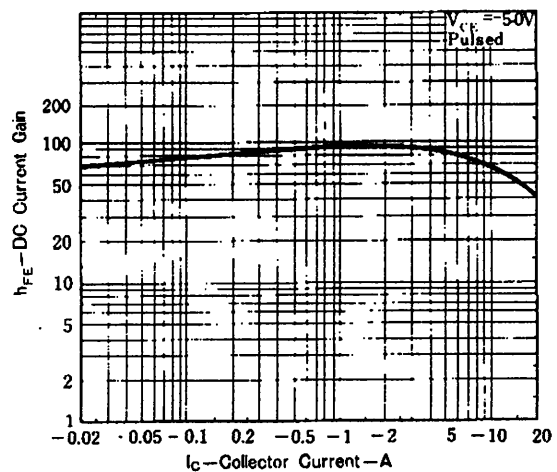
TRANSIENT THERMAL RESISTANCE

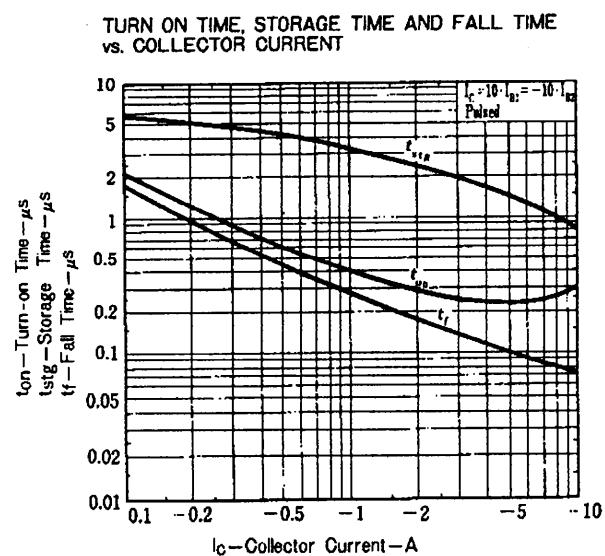
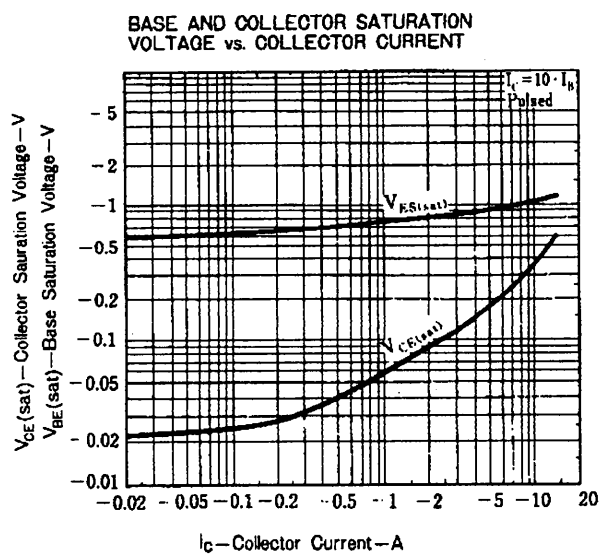


COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



DC CURRENT GAIN vs. COLLECTOR CURRENT





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