

Econo IPM series

600V / 50A 6 in one-package

Features

- Temperature protection provided by directly detecting the junction temperature of the IGBTs
- Low power loss and soft switching
- High performance and high reliability IGBT with overheating protection
- Higher reliability because of a big decrease in number of parts in built-in control circuit



Maximum ratings and characteristics

- Absolute maximum ratings(at Tc=25°C unless otherwise specified)

Item			Symbol	Rating		Unit
				Min.	Max.	
Bus voltage	DC		V _{DC}	0	450	V
	Surge		V _{DC(surge)}	0	500	V
	Short operating		V _{SC}	200	400	V
Collector-Emitter voltage *1			V _{CES}	0	600	V
Inverter	Collector current	DC	I _C	-	50	A
		1ms	I _{CP}	-	100	A
		Duty=76.1% *2	-I _C	-	50	A
	Collector power dissipation	One transistor *3	P _C	-	144	W
Supply voltage of Pre-Driver *4			V _{CC}	-0.5	20	V
Input signal voltage *5			V _{in}	-0.5	V _{CC} +0.5	V
Input signal current			I _{in}	-	3	mA
Alarm signal voltage *6			V _{ALM}	-0.5	V _{CC}	V
Alarm signal current *7			I _{ALM}	-	20	mA
Junction temperature			T _j	-	150	°C
Operating case temperature			T _{opr}	-20	100	°C
Storage temperature			T _{stg}	-40	125	°C
Solder temperature *8			T _{sol}	-	260	°C
Isolating voltage (Terminal to base, 50/60Hz sine wave 1min.)			V _{iso}	-	AC2500	V
Screw torque	Mounting (M5)			-	3.5	N·m

Note

*1 : V_{CES} shall be applied to the input voltage between terminal P and U or ,u or W, N and U or V or W

*2 : $125^{\circ}\text{C}/\text{FWD } R_{\text{th(j-c)}}/(I_{\text{C}} \times V_{\text{F MAX}})=125/1.263/(50 \times 2.6) \times 100=76.1\%$

*3 : $P_{\text{C}}=125^{\circ}\text{C}/\text{IGBT } R_{\text{th(j-c)}}=125/0.87=144\text{W}$ [Inverter]

*4 : V_{CC} shall be applied to the input voltage between terminal No.4 and 1, 8 and 5, 12 and 9, 14 and 13

*5 : V_{in} shall be applied to the input voltage between terminal No.3 and 1, 7 and 5, 11 and 9, 16,17,18 and 13.

*6 : V_{ALM} shall be applied to the voltage between terminal No.2 and 1, No6 and 5, No10 and 9, No.19 and 13.

*7 : I_{ALM} shall be applied to the input current to terminal No.2,6,10 and 19.

*8 : Immersion time 10±1sec.

● **Electrical characteristics** (at $T_c=T_j=25^{\circ}\text{C}$, $V_{cc}=15\text{V}$ unless otherwise specified.)

Main circuit

Item		Symbol	Condition		Min.	Typ.	Max.	Unit
Inverter	Collector current at off signal input	ICES	VCE=600V Vin terminal open.		-	-	1.0	mA
	Collector-Emitter saturation voltage	VCE(sat)	Ic=50A	Terminal	-	-	2.5	V
				Chip	-	2.0	-	
	Forward voltage of FWD	VF	-Ic=50A	Terminal	-	-	2.6	V
				Chip	-	1.6	-	
Turn-on time		ton	VDC=300V,Tj=125°C		1.2	-	-	µs
Turn-off time		toff	IC=50A Fig.1, Fig.6		-	-	3.6	
Reverse recovery time		trr	VDC=300V, IC=50A Fig.1, Fig.6		-	-	0.3	
Maximum Avalanche Energy (A non-repetition)		PAV	Internal wiring inductance=50nH Main circuit wiring inductace=54nH		30	-	-	mJ

● **Control circuit**

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply current of P-line side pre-driver(one unit)	I_{ccp}	Switching Frequency : 0 to 15kHz $T_c=-20$ to 125°C Fig.7	-	-	18	mA
Supply current of N-line side pre-driver	I_{ccn}		-	-	65	mA
Input signal threshold voltage (on/off)	$V_{in(th)}$	ON	1.00	1.35	1.70	V
		OFF	1.25	1.60	1.95	V
Input zener voltage	V_Z	$R_{in}=20\text{k ohm}$	-	8.0	-	V
Alarm signal hold time	t_{ALM}	$T_c=-20^{\circ}\text{C}$ Fig.2	1.1	-	-	ms
		$T_c=25^{\circ}\text{C}$ Fig.2	-	2.0	-	ms
		$T_c=125^{\circ}\text{C}$ Fig.2	-	-	4.0	ms
Current limit resistor	R_{ALM}	Alarm terminal	1425	1500	1575	ohm

● **Protection Section** ($V_{cc}=15\text{V}$)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Over Current Protection Level of Inverter circuit	I_{oc}	$T_j=125^{\circ}\text{C}$	75	-	-	A
Over Current Protection Delay time	t_{doc}	$T_j=125^{\circ}\text{C}$	-	5	-	μs
SC Protection Delay time	t_{sc}	$T_j=125^{\circ}\text{C}$ Fig.4	-	-	8	μs
IGBT Chip Over Heating	T_{jOH}	Surface of IGBT chips	150	-	-	$^{\circ}\text{C}$
Over Heating Protection Hysteresis	T_{jH}		-	20	-	$^{\circ}\text{C}$
Under Voltage Protection Level	V_{uv}		11.0	-	12.5	V
Under Voltage Protection Hysteresis	V_H		0.2	0.5	-	V

● **Thermal characteristics**($T_c=25^{\circ}\text{C}$)

Item			Symbol	Min.	Typ.	Max.	Unit
Junction to Case thermal resistance *10	Inverter	IGBT	$R_{th(j-c)}$	-	-	0.87	$^{\circ}\text{C/W}$
		FWD	$R_{th(j-c)}$	-	-	1.263	$^{\circ}\text{C/W}$
Case to fin thermal resistance with compound			$R_{th(c-f)}$	-	0.05	-	$^{\circ}\text{C/W}$

*10 : (For 1 device, Case is under the device)

● **Noise Immunity** ($V_{DC}=300\text{V}$, $V_{cc}=15\text{V}$, Test Circuit Fig.5)

Item	Condition	Min.	Typ.	Max.	Unit
Common mode rectangular noise	Pulse width 1 μs , polarity $\pm 10\text{minuets}$ Judge : no over-current, no miss operating	± 2.0	-	-	kV
Common mode lightning surge	Rise time 1.2 μs , Fall time 50 μs Interval 20s, 10 times Judge : no over-current, no miss operating	± 5.0	-	-	kV

● **Recommendable value**

Item	Symbol	Min.	Typ.	Max.	Unit
DC Bus Voltage	V_{DC}	-	-	400	V
Operating Supply Voltage of Pre-Driver	V_{cc}	13.5	15.0	16.5	V
Screw torque (M5)	-	2.5	-	3.0	Nm

● **Weight**

Item	Symbol	Min.	Typ.	Max.	Unit
Weight	W_t	-	270	-	g

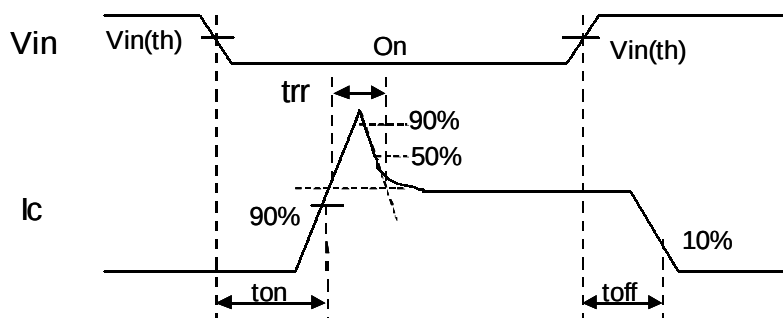
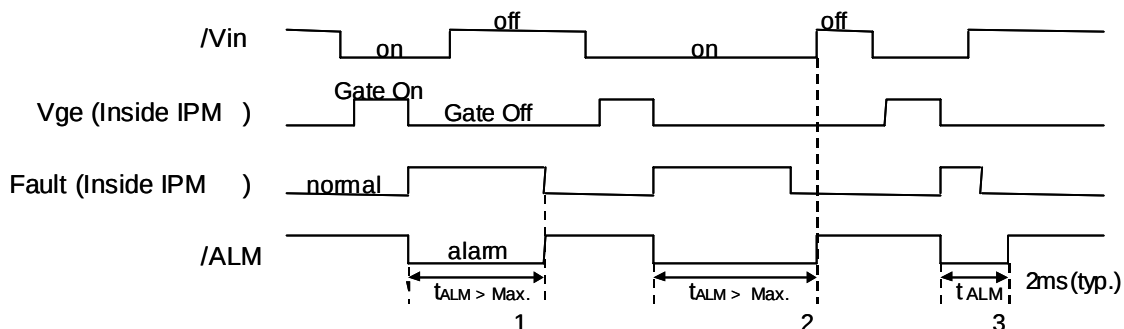


Figure 1. Switching Time Waveform Definitions



Fault : Over-current, Over-heat or Under-voltage

Figure 2. Input/Output Timing Diagram

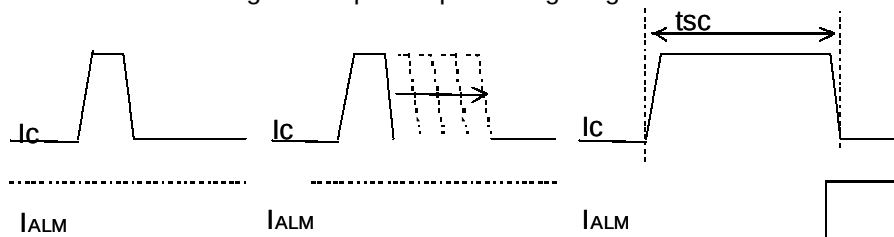


Figure.4 Definition of tsc

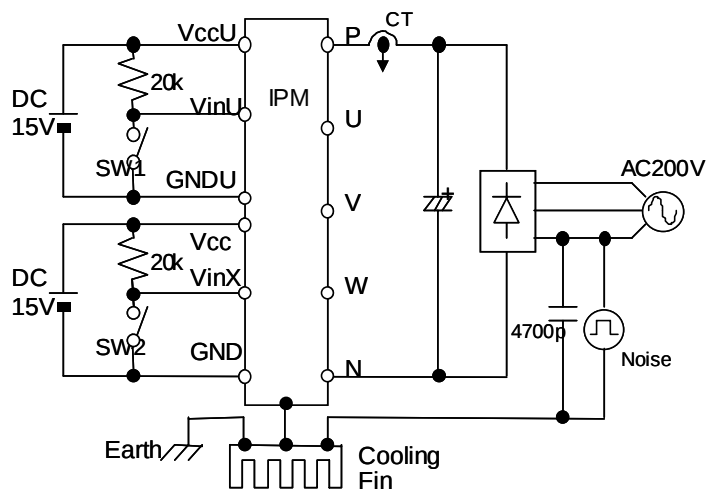


Figure 5. Noise Test Circuit

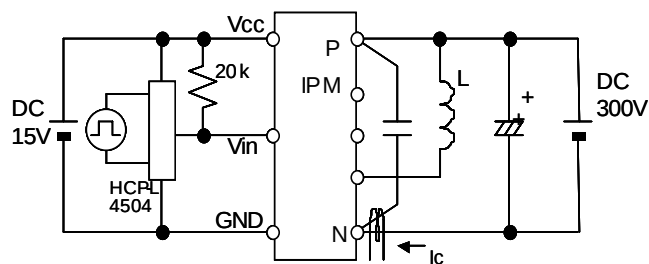


Figure 6. Switching Characteristics Test Circuit

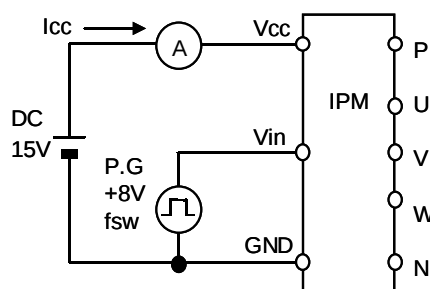
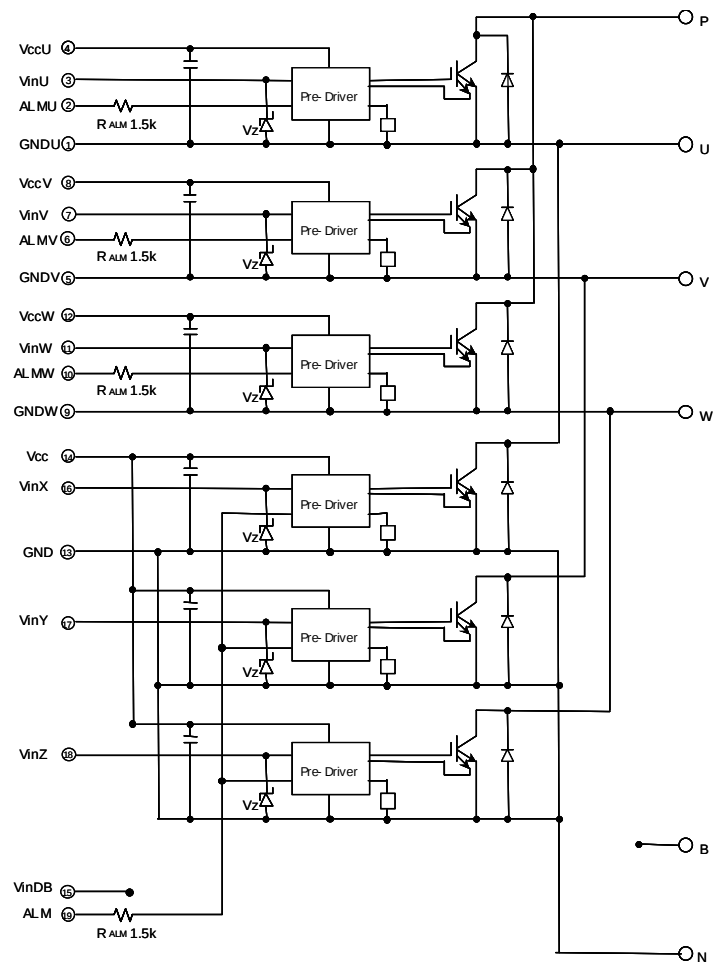


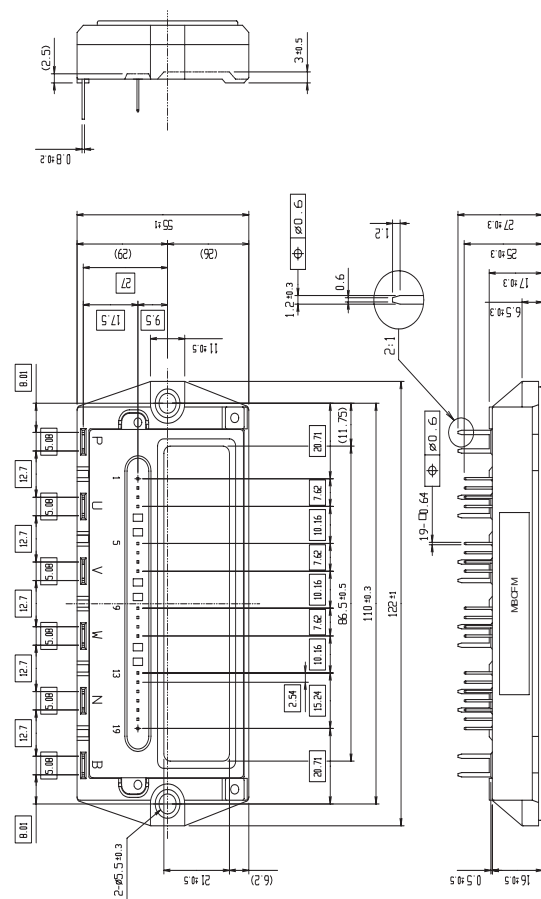
Figure 7. Icc Test Circuit

Block diagram



- Pre-drivers include following functions
- 1. Amplifier for driver
 - 2. Short circuit protection
 - 3. Under voltage lockout circuit
 - 4. Over current protection
 - 5. IGBT chip over heating protection

Outline drawings, mm

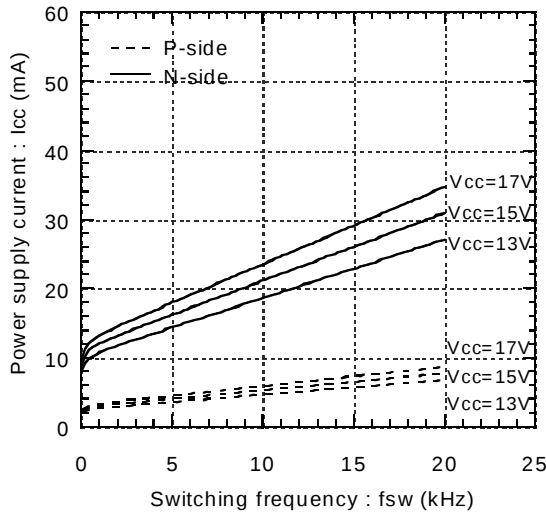


Mass : 270g

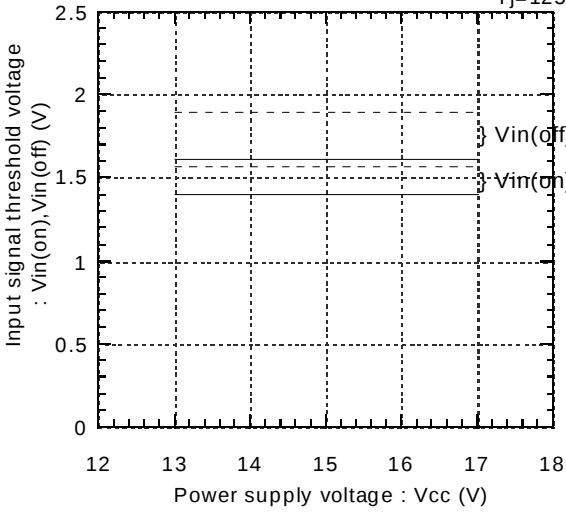
Characteristics

Control circuit characteristics (Representative)

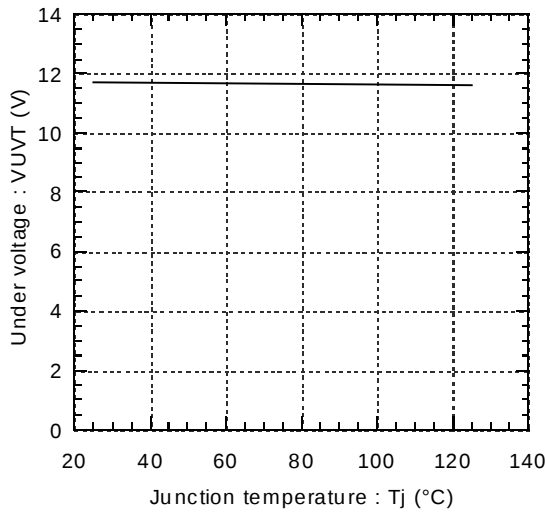
Power supply current vs. Switching frequency
Tc=125°C



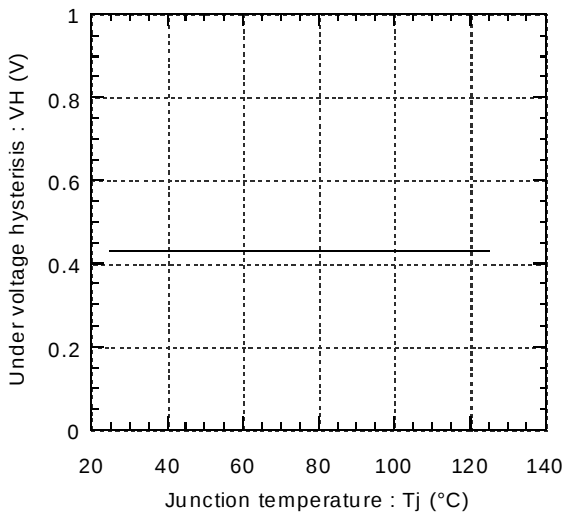
Input signal threshold voltage vs. Power supply voltage
Tj=25°C (solid line), Tj=125°C (dashed line)



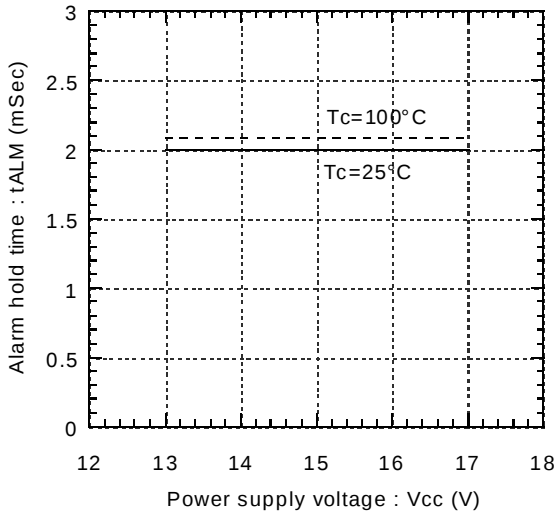
Under voltage vs. Junction temperature



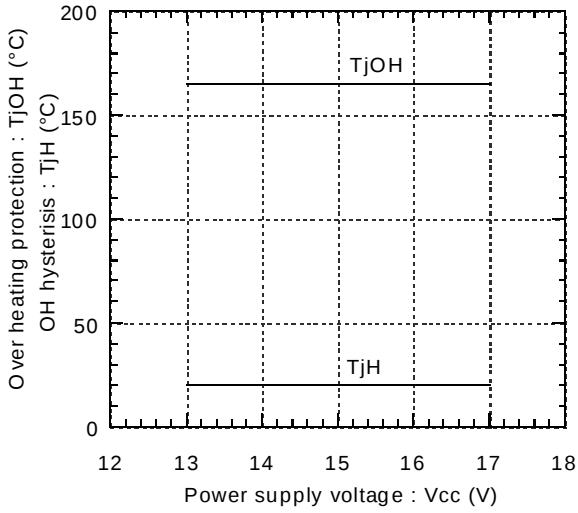
Under voltage hysteresis vs. Jnction temperature



Alarm hold time vs. Power supply voltage

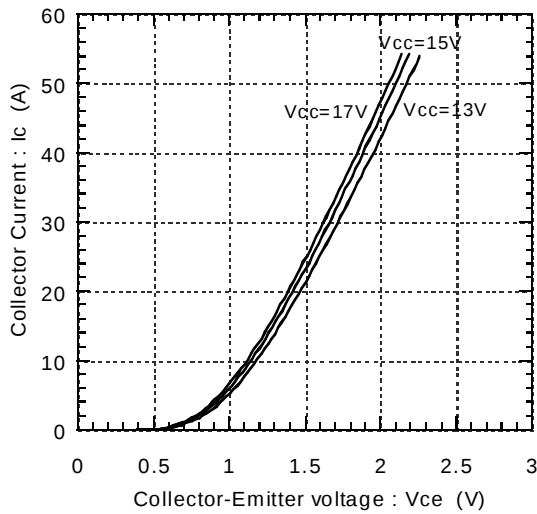


Over heating characteristics
TjOH, TjH vs. Vcc

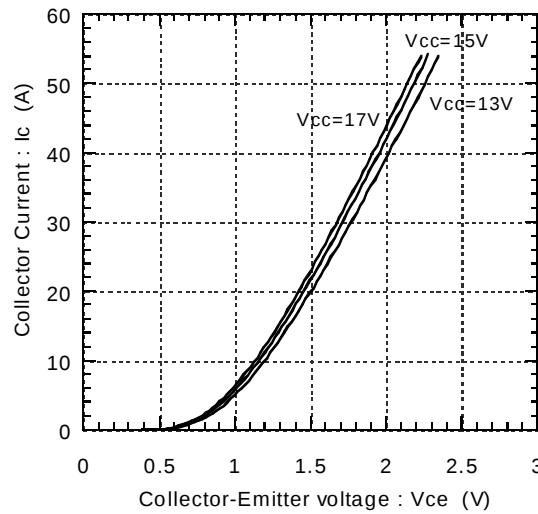


● Main circuit characteristics (Representative)

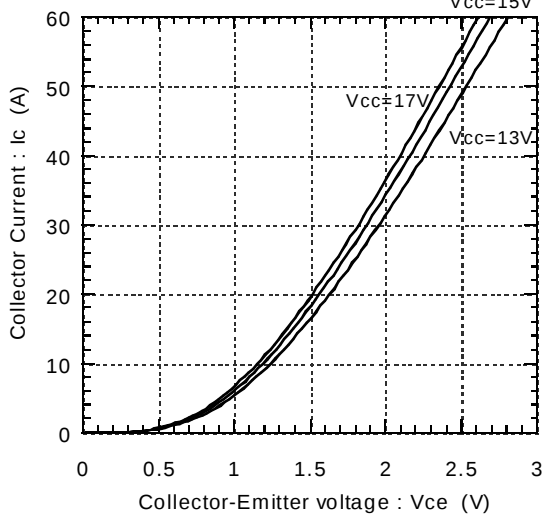
Collector current vs. Collector-Emitter voltage
 $T_j=25^{\circ}\text{C}$ (Chip)



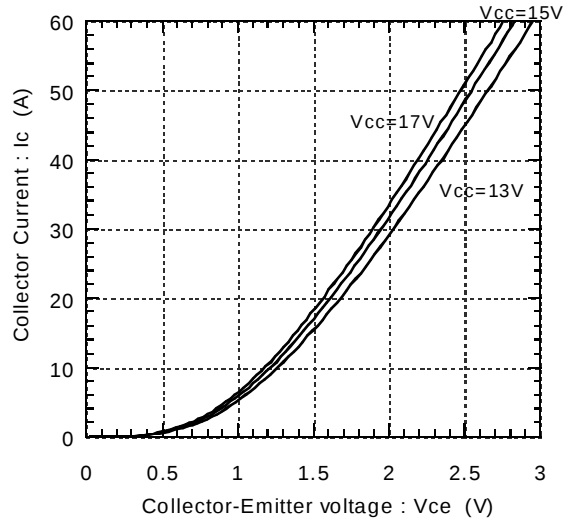
Collector current vs. Collector-Emitter voltage
 $T_j=25^{\circ}\text{C}$ (Terminal)



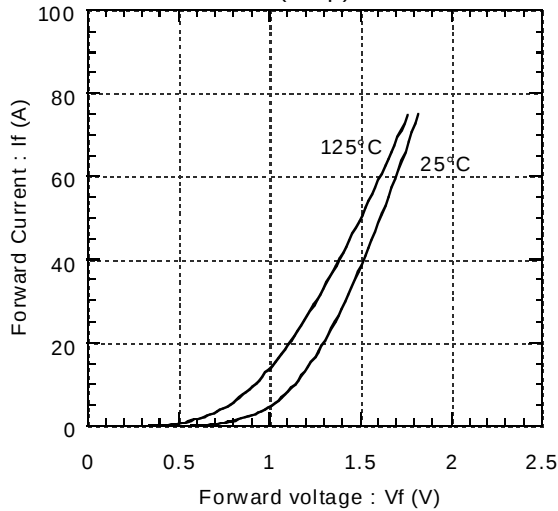
Collector current vs. Collector-Emitter voltage
 $T_j=125^{\circ}\text{C}$ (Chip)



Collector current vs. Collector-Emitter voltage
 $T_j=125^{\circ}\text{C}$ (Terminal)



Forward current vs. Forward voltage
(Chip)



Forward current vs. Forward voltage
(Terminal)

