Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of "Quality Parts,Customers Priority,Honest Operation,and Considerate Service",our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

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Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
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Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

PM100CL1A060

FLAT-BASE TYPE
INSULATED PACKAGE

PM100CL1A060

FEATURE
Inverter + Drive & Protection IC

a) Adopting new 5th generation Full-Gate CSTBT™ chip
b) The over-temperature protection which detects the chip sur-face temperature of CSTBT™ is adopted.
c) Error output signal is possible from all each protection up-per and lower arm of IPM.
d) Compatible L-series package.

- 3φ 100A, 600V Current-sense and temperature sense IGBT type inverter
- Monolithic gate drive & protection logic
- Detection, protection & status indication circuits for, short-circuit, over-temperature & under-voltage (P-FO available from upper arm devices)
- UL Recognized

APPLICATION
General purpose inverter, servo drives and other motor controls

PACKAGE OUTLINES   **Dimensions in mm**

Terminal code

1. VUPC	8. VVP1	15. NC
2. UFO	9. VWPC	16. UN
3. UP	10. WFO	17. VN
4. VUP1	11. WP	18. WN
5. VVPC	12. VWP1	19. Fo
6. VFO	13. VNC	
7. VP	14. VN1	

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FLAT-BASE TYPE
INSULATED PACKAGE

INTERNAL FUNCTIONS BLOCK DIAGRAM
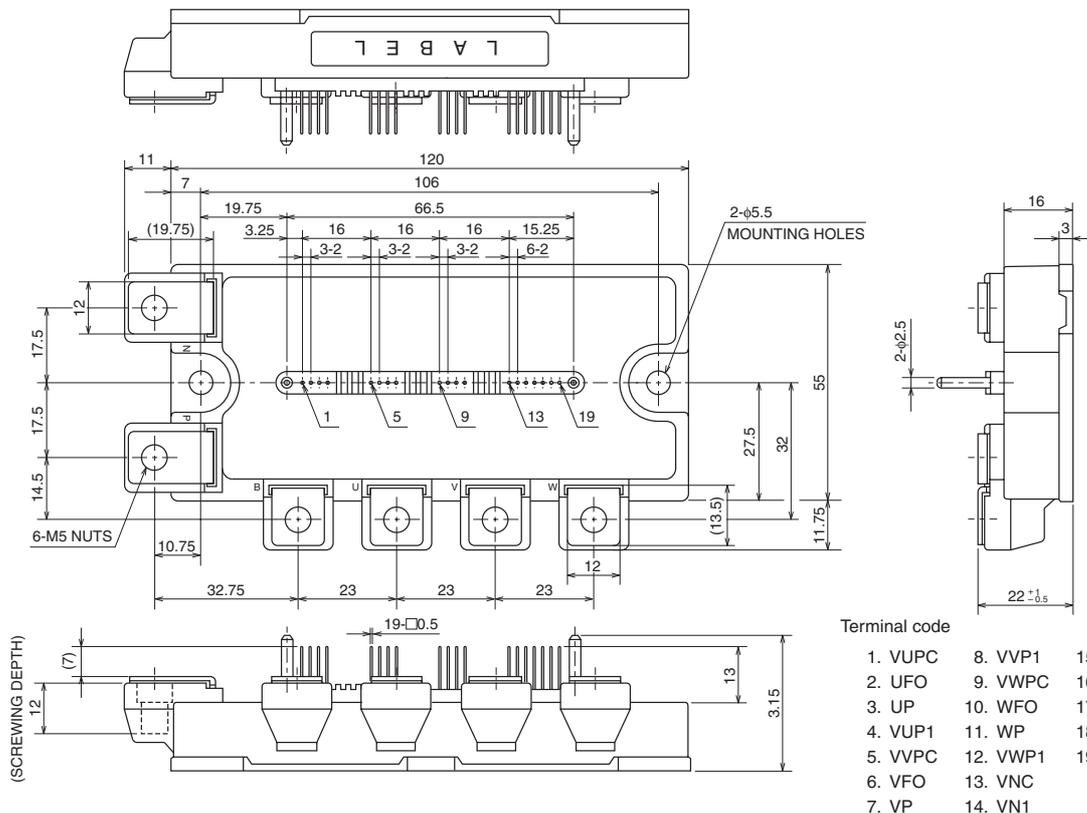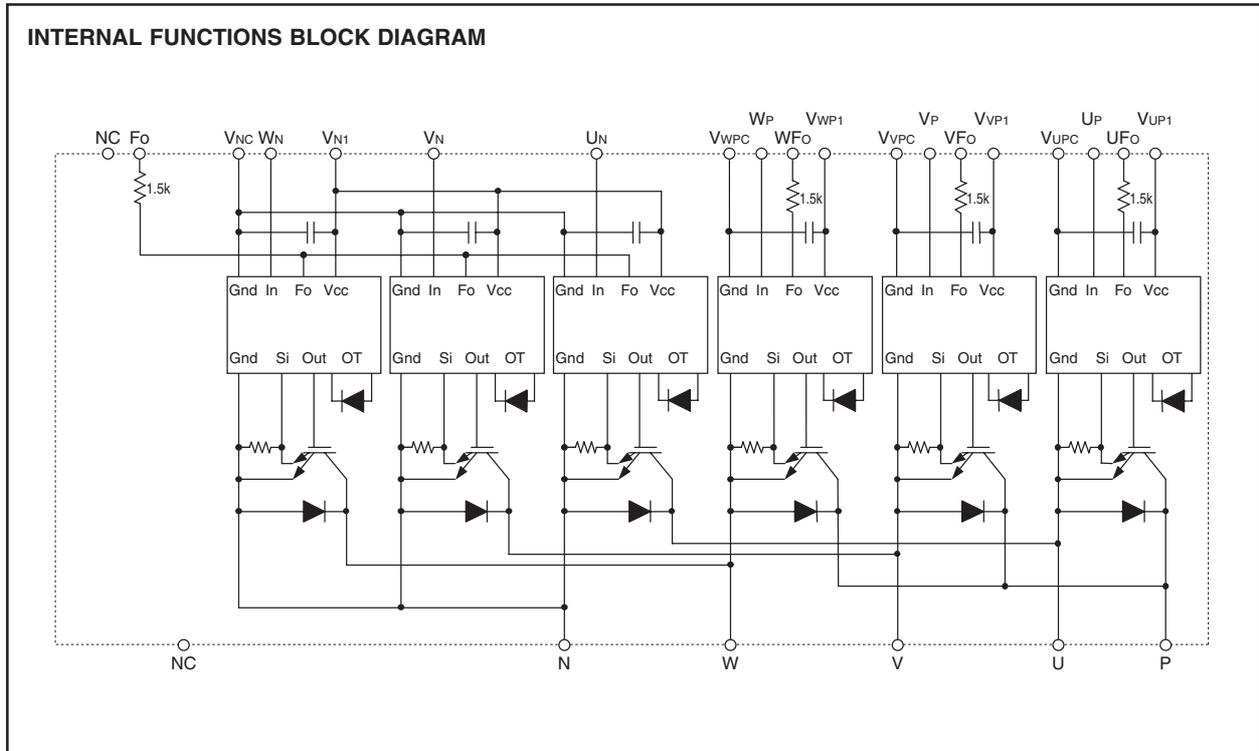
MAXIMUM RATINGS (T_j = 25°C, unless otherwise noted)
INVERTER PART

Symbol	Parameter	Condition		Ratings	Unit
V_{CES}	Collector-Emitter Voltage	V_D = 15V, V_{CIN} = 15V		600	V
$\pm I_C$	Collector Current	T_C = 25°C	(Note-1)	100	A
$\pm I_{CP}$	Collector Current (Peak)	T_C = 25°C		200	A
P_C	Collector Dissipation	T_C = 25°C	(Note-1)	390	W
T_j	Junction Temperature			−20 ~ +150	°C

*: Tc measurement point is just under the chip.

CONTROL PART

Symbol	Parameter	Condition	Ratings	Unit
V_D	Supply Voltage	Applied between : V_{UP1}-V_{UPC}, V_{VP1}-V_{VPC} V_{WP1}-V_{WPC}, V_{N1}-V_{NC}	20	V
V_{CIN}	Input Voltage	Applied between : U_P-V_{UPC}, V_P-V_{VPC}, W_P-V_{WPC} U_N • V_N • W_N-V_{NC}	20	V
V_{FO}	Fault Output Supply Voltage	Applied between : U_{FO}-V_{UPC}, V_{FO}-V_{VPC}, W_{FO}-V_{WPC} F_O-V_{NC}	20	V
I_{FO}	Fault Output Current	Sink current at U_{FO}, V_{FO}, W_{FO}, F_O terminals	20	mA

PM100CL1A060

**FLAT-BASE TYPE
INSULATED PACKAGE**

TOTAL SYSTEM

Symbol	Parameter	Condition	Ratings	Unit
$V_{CC(PROT)}$	Supply Voltage Protected by SC	V_D = 13.5 ~ 16.5V Inverter Part, T_j = +125°C Start	400	V
$V_{CC(surge)}$	Supply Voltage (Surge)	Applied between : P-N, Surge value	500	V
T_{stg}	Storage Temperature		−40 ~ +125	°C
V_{iso}	Isolation Voltage	60Hz, Sinusoidal, Charged part to Base, AC 1 min.	2500	V_{rms}

THERMAL RESISTANCES

Symbol	Parameter	Condition		Limits			Unit
				Min.	Typ.	Max.	
$R_{th(j-c)Q}$	Junction to case Thermal Resistances	Inverter IGBT part (per 1 element)	(Note-1)	—	—	0.32	
$R_{th(j-c)F}$		Inverter FWDi part (per 1 element)	(Note-1)	—	—	0.52	°C/W
$R_{th(c-f)}$	Contact Thermal Resistance	Case to fin, (per 1 module) Thermal grease applied	(Note-1)	—	—	0.038	

* If you use this value, $R_{th(f-a)}$ should be measured just under the chips.

(Note-1) Tc (under the chip) measurement point is below.   (unit : mm)

arm axis	UP		VP		WP		UN		VN		WN	
	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi
X	28.6	28.6	65.4	65.4	87.4	87.4	38.6	38.6	54.6	54.6	76.6	76.6
Y	−9.0	−0.4	−9.0	−0.4	−9.0	−0.4	6.5	−1.1	6.5	−1.1	6.5	−1.1
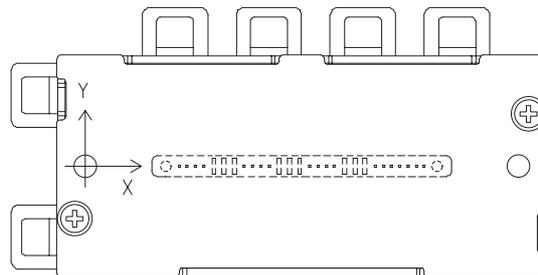
Bottom view

ELECTRICAL CHARACTERISTICS (T_j = 25°C, unless otherwise noted)
INVERTER PART

Symbol	Parameter	Condition		Limits			Unit
				Min.	Typ.	Max.	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_D = 15V, I_C = 100A	T_j = 25°C	—	1.75	2.35	V
		V_{CIN} = 0V, Pulsed (Fig. 1)	T_j = 125°C	—	1.75	2.35	
V_{EC}	FWDi Forward Voltage	$-I_C$ = 100A, V_D = 15V, V_{CIN} = 15V (Fig. 2)		—	1.7	2.8	V
t_{on}	Switching Time	V_D = 15V, V_{CIN} = 0V↔15V V_{CC} = 300V, I_C = 100A T_j = 125°C Inductive Load (Fig. 3,4)		0.3	0.8	2.0	μs
t_{rr}				—	0.4	0.8	
$t_{c(on)}$				—	0.4	1.0	
t_{off}				—	1.0	2.3	
$t_{c(off)}$				—	0.3	1.0	
I_{CES}	Collector-Emitter Cutoff Current	V_{CE} = V_{CES}, V_D = 15V (Fig. 5)	T_j = 25°C	—	—	1	mA
			T_j = 125°C	—	—	10	

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FLAT-BASE TYPE
INSULATED PACKAGE

CONTROL PART

Symbol	Parameter	Condition		Limits			Unit
				Min.	Typ.	Max.	
ID	Circuit Current	VD = 15V, VCIN = 15V	VN1-VNC	—	6	12	mA
			V*P1-V*PC	—	2	4	
Vth(ON)	Input ON Threshold Voltage	Applied between : UP-VUPC, VP-VVPC, WP-VWPC		1.2	1.5	1.8	V
Vth(OFF)	Input OFF Threshold Voltage	UN • VN • WN-VNC		1.7	2.0	2.3	
SC	Short Circuit Trip Level	−20 ≤ Tj ≤ 125°C, VD = 15V (Fig. 3,6)		200	—	—	A
toff(SC)	Short Circuit Current Delay Time	VD = 15V (Fig. 3,6)		—	0.2	—	µs
OT	Over Temperature Protection	Detect Temperature of IGBT chip	Trip level	135	—	—	°C
OT(hys)			Hysteresis	—	20	—	
UV	Supply Circuit Under-Voltage Protection	−20 ≤ Tj ≤ 125°C	Trip level	11.5	12.0	12.5	V
UVr			Reset level	—	12.5	—	
IFO(H)	Fault Output Current	VD = 15V, VCIN = 15V (Note-2)		—	—	0.01	mA
IFO(L)				—	10	15	
tFO	Minimum Fault Output Pulse Width	VD = 15V (Note-2)		1.0	1.8	—	ms

(Note-2) Fault output is given only when the internal SC, OT & UV protections schemes of either upper or lower arm device operate to protect it.

MECHANICAL RATINGS AND CHARACTERISTICS

Symbol	Parameter	Condition		Limits			Unit
				Min.	Typ.	Max.	
—	Mounting torque	Mounting part	screw : M5	2.5	3.0	3.5	N • m
		Main terminal part	screw : M5	2.5	3.0	3.5	
—	Weight	—		—	380	—	g

RECOMMENDED CONDITIONS FOR USE

Symbol	Parameter	Condition	Recommended value	Unit
VCC	Supply Voltage	Applied across P-N terminals	≤ 400	V
VD	Control Supply Voltage	Applied between : VUP1-VUPC, VVP1-VVPC VWP1-VWPC, VN1-VNC (Note-3)	15.0 ± 1.5	V
VCIN(ON)	Input ON Voltage	Applied between : UP-VUPC, VP-VVPC, WP-VWPC	≤ 0.8	V
VCIN(OFF)	Input OFF Voltage	UN • VN • WN-VNC	≥ 9.0	
fPWM	PWM Input Frequency	Using Application Circuit of Fig. 8	≤ 20	kHz
tdead	Arm Shoot-through Blocking Time	For IPM's each input signals (Fig. 7)	≥ 2.0	µs

(Note-3) With ripple satisfying the following conditions: dv/dt swing ≤ ±5V/µs, Variation ≤ 2V peak to peak
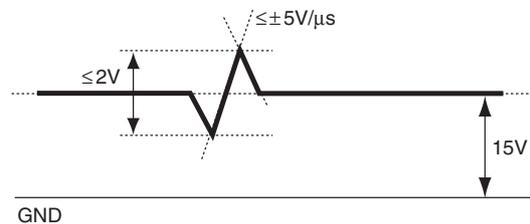
PRECAUTIONS FOR TESTING

1. Before applying any control supply voltage (V_D), the input terminals should be pulled up by resistors, etc. to their corresponding supply voltage and each input signal should be kept off state.
   After this, the specified ON and OFF level setting for each input signal should be done.

2. When performing "SC" tests, the turn-off surge voltage spike at the corresponding protection operation should not be allowed to rise above V_{CES} rating of the device.
   (These test should not be done by using a curve tracer or its equivalent.)

Fig. 1 $V_{CE(sat)}$ Test

Fig. 2 V_{EC}, (V_{FM}) Test

a) Lower Arm Switching

b) Upper Arm Switching

Fig. 3 Switching time and SC test circuit

Fig. 4 Switching time test waveform

$(t_{on} = t_{d(on)} + t_r)$ $(t_{off} = t_{d(off)} + t_f)$

Fig. 5 I_{CES} Test

Fig. 6 SC test waveform

1.5V: Input on threshold voltage Vth(on) typical value, 2V: Input off threshold voltage Vth(off) typical value
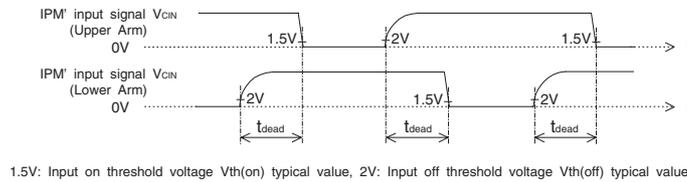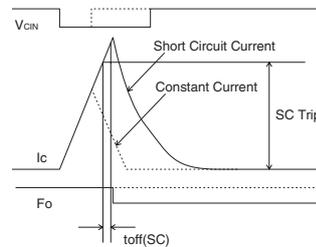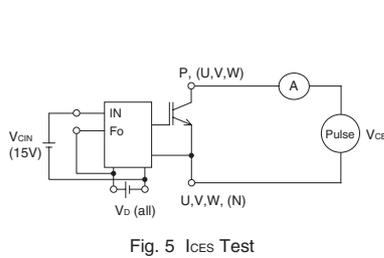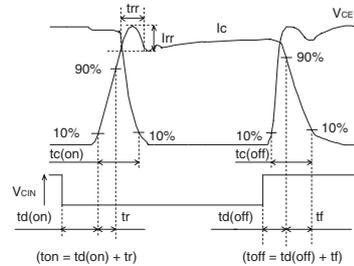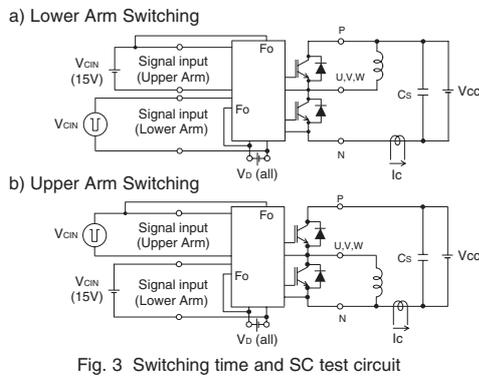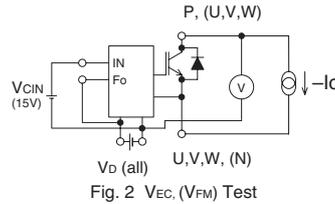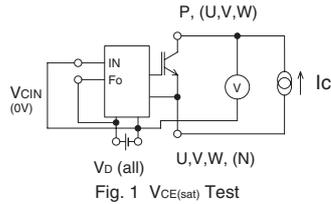
Fig. 7 Dead time measurement point example
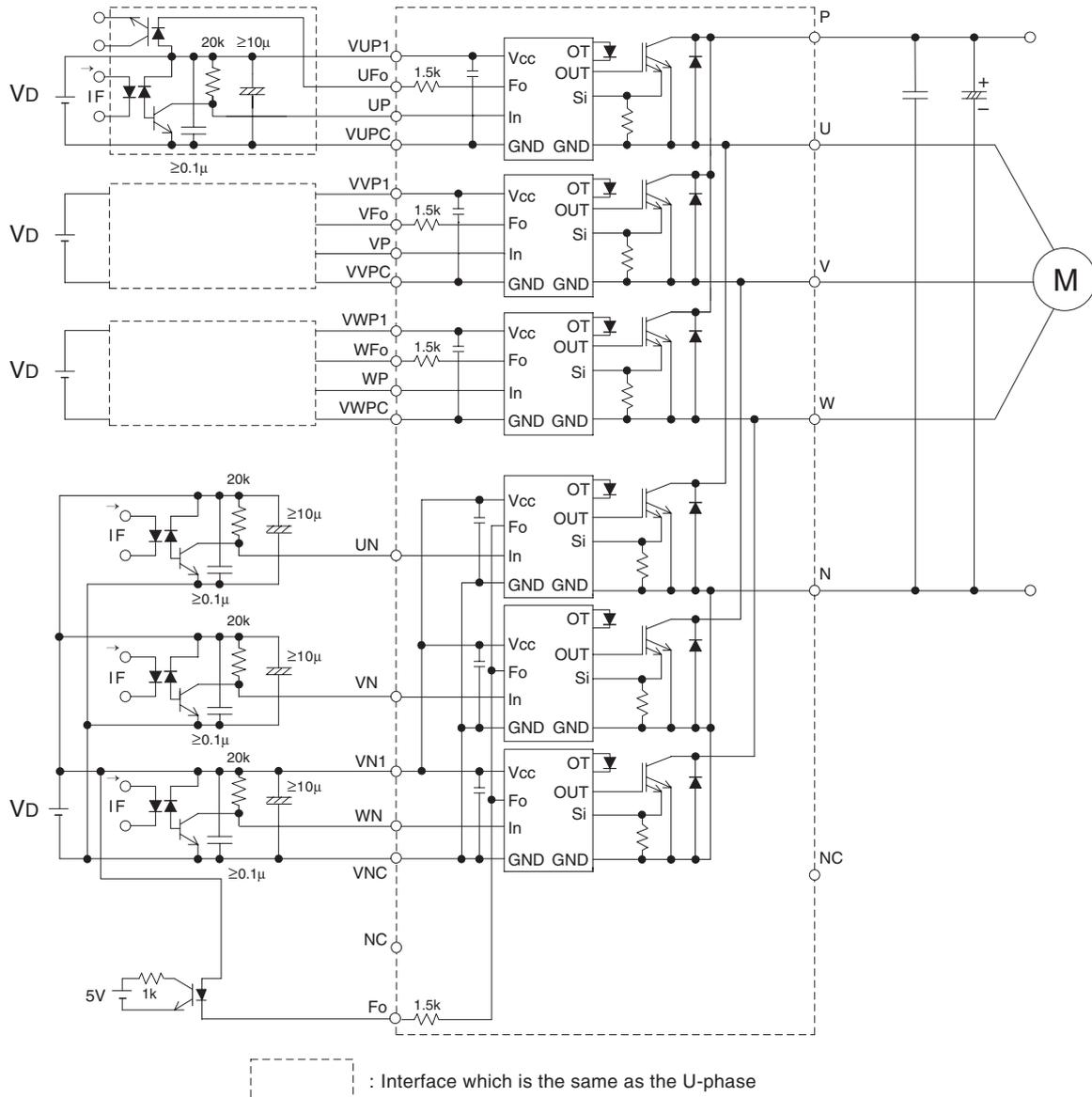
Fig. 8 Application Example Circuit

: Interface which is the same as the U-phase

**NOTES FOR STABLE AND SAFE OPERATION ;**

- Design the PCB pattern to minimize wiring length between opto-coupler and IPM's input terminal, and also to minimize the stray capacity between the input and output wirings of opto-coupler.
- Connect low impedance capacitor between the Vcc and GND terminal of each fast switching opto-coupler.
- Fast switching opto-couplers: t_{PLH}, $t_{PHL} \leq 0.8\mu s$, Use High CMR type.
- Slow switching opto-coupler: CTR > 100%
- Use 4 isolated control power supplies (V_D). Also, care should be taken to minimize the instantaneous voltage charge of the power supply.
- Make inductance of DC bus line as small as possible, and minimize surge voltage using snubber capacitor between P and N terminal.
- Use line noise filter capacitor (ex. 4.7nF) between each input AC line and ground to reject common-mode noise from AC line and improve noise immunity of the system.

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**FLAT-BASE TYPE**
INSULATED PACKAGE

PERFORMANCE CURVES

OUTPUT CHARACTERISTICS (TYPICAL)

Tj = 25°C
15V
VD = 17V
13V

COLLECTOR CURRENT Ic (A)
COLLECTOR-EMITTER VOLTAGE VCE (V)
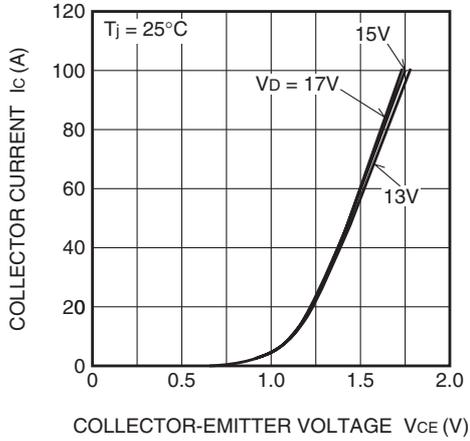
COLLECTOR-EMITTER SATURATION VOLTAGE (VS. Ic) CHARACTERISTICS (TYPICAL)

VD = 15V
Tj = 25°C
Tj = 125°C

COLLECTOR-EMITTER SATURATION VOLTAGE VCE(sat) (V)
COLLECTOR CURRENT Ic (A)
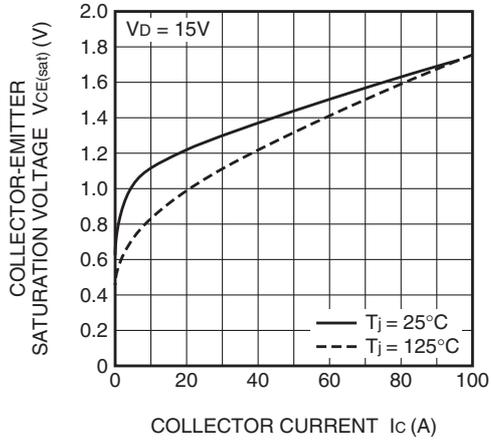
COLLECTOR-EMITTER SATURATION VOLTAGE (VS. VD) CHARACTERISTICS (TYPICAL)

Ic = 100A
Tj = 25°C
Tj = 125°C

COLLECTOR-EMITTER SATURATION VOLTAGE VCE(sat) (V)
CONTROL VOLTAGE VD (V)
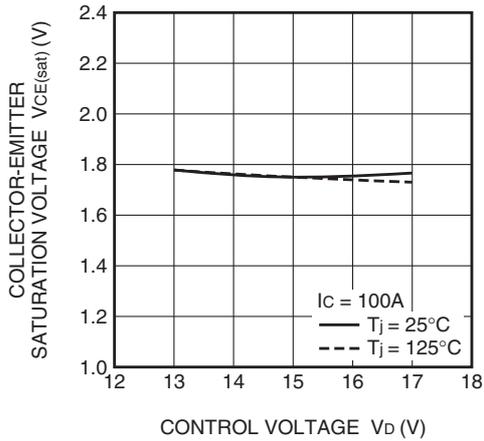
DIODE FORWARD CHARACTERISTICS (TYPICAL)

VD = 15V
Tj = 25°C
Tj = 125°C

COLLECTOR RECOVERY CURRENT –Ic (A)
EMITTER-COLLECTOR VOLTAGE VEC (V)
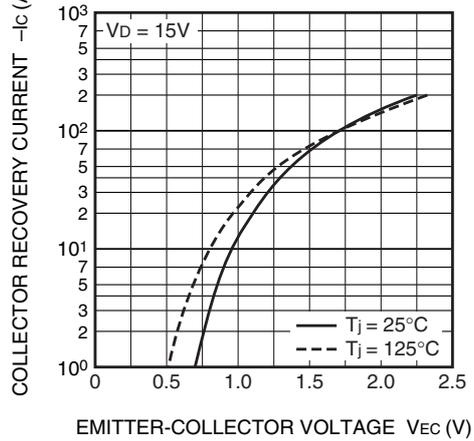
SWITCHING TIME (ton, toff) CHARACTERISTICS (TYPICAL)

VCC = 300V
VD = 15V
Tj = 25°C
Tj = 125°C
Inductive load
toff
ton

SWITCHING TIME ton, toff (μs)
COLLECTOR CURRENT Ic (A)
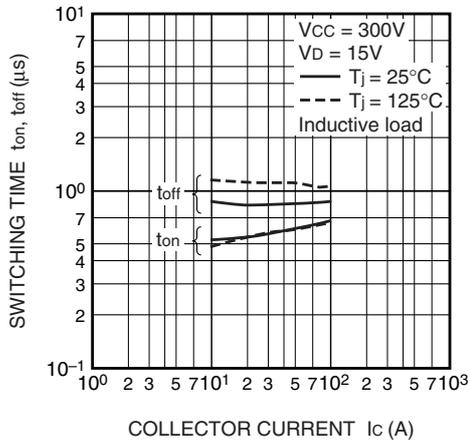
SWITCHING TIME (tc(on), tc(off)) CHARACTERISTICS (TYPICAL)

tc(off)
tc(on)
tc(off)
VCC = 300V
VD = 15V
Tj = 25°C
Tj = 125°C
Inductive load

SWITCHING TIME tc(on), tc(off) (μs)
COLLECTOR CURRENT Ic (A)

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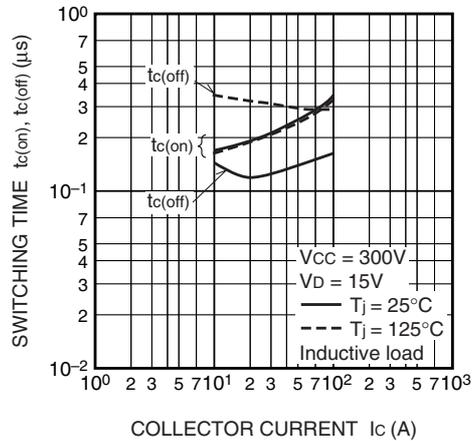
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SWITCHING LOSS CHARACTERISTICS
(TYPICAL)

VCC = 300V
VD = 15V
—— Tj = 25°C
- - - Tj = 125°C
Inductive load

Eon

Eoff

SWITCHING LOSS Eon, Eoff (mJ/pulse) vs. COLLECTOR CURRENT IC (A)
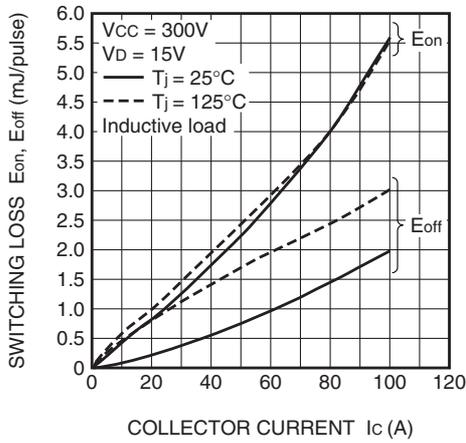
DIODE REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)

VCC = 300V
VD = 15V
—— Tj = 25°C
- - - Tj = 125°C
Inductive load

Irr

trr

REVERSE RECOVERY TIME trr (µs) / REVERSE RECOVERY CURRENT Irr (A) vs. COLLECTOR REVERSE CURRENT −IC (A)
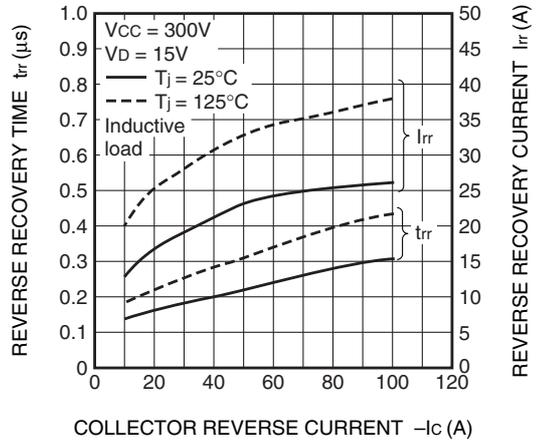
SWITCHING RECOVERY LOSS CHARACTERISTICS
(TYPICAL)
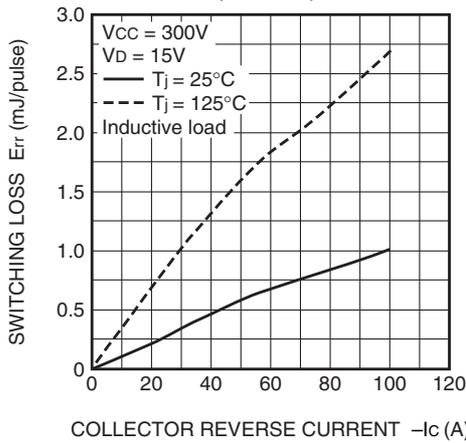
VCC = 300V
VD = 15V
—— Tj = 25°C
- - - Tj = 125°C
Inductive load

SWITCHING LOSS Err (mJ/pulse) vs. COLLECTOR REVERSE CURRENT −IC (A)

ID VS. fc CHARACTERISTICS
(TYPICAL)

VD = 15V
—— Tj = 25°C
- - - Tj = 125°C

N-side

P-side

ID (mA) vs. fc (kHz)

UV TRIP LEVEL VS. Tj CHARACTERISTICS
(TYPICAL)

—— UVt
- - - UVr

UVt/UVr (V) vs. Tj (°C)

SC TRIP LEVEL VS. Tj CHARACTERISTICS
(TYPICAL)

VD = 15V

SC (SC of Tj = 25°C is normalized 1) vs. Tj (°C)

TRANSIENT THERMAL
IMPEDANCE CHARACTERISTICS
(TYPICAL)

Single Pulse
IGBT part;
Per unit base = $R_{th(j-c)}Q = 0.32°C/W$
FWDi part;
Per unit base = $R_{th(j-c)}F = 0.52°C/W$

NORMALIZED TRANSIENT THERMAL IMPEDANCE $Z_{th(j-c)}$

TIME t (sec)