![Chipsmall]

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!

Contact us

PM75CL1A120

FLAT-BASE TYPE
INSULATED PACKAGE

PM75CL1A120

FEATURE
Inverter + Drive & Protection IC
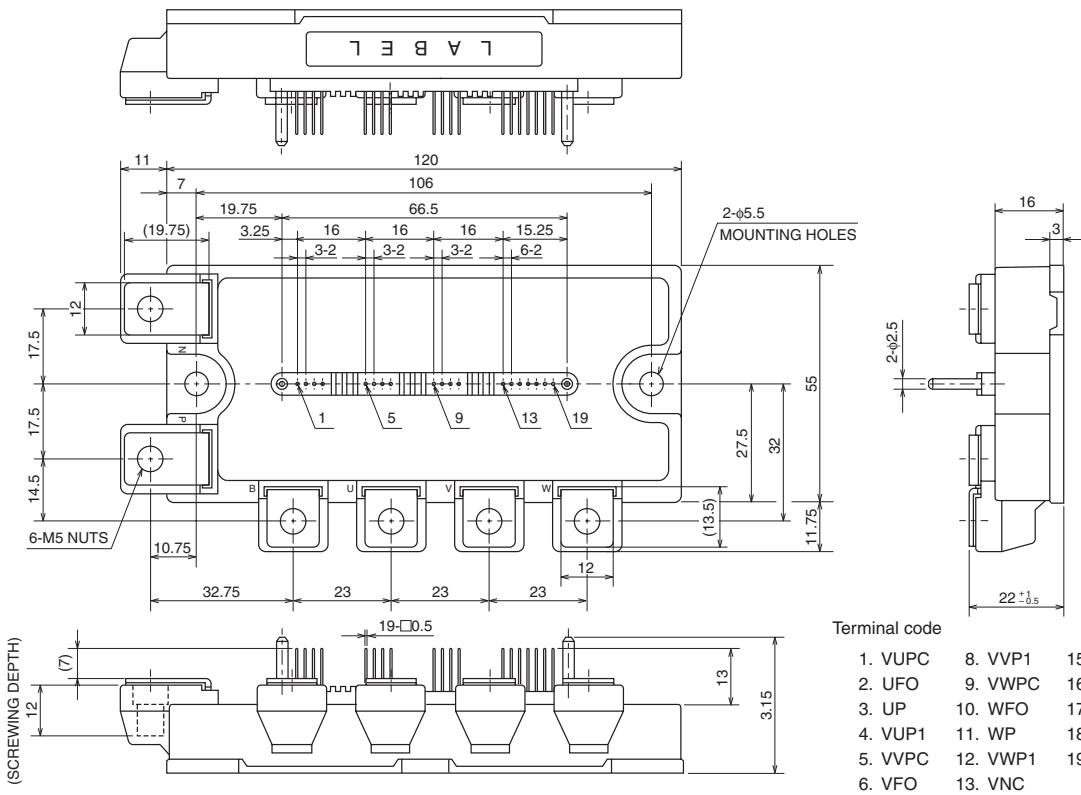
a) Adopting new 5th generation Full-Gate CSTBT^{TM} chip
b) The over-temperature protection which detects the chip surface temperature of CSTBT^{TM} is adopted.
c) Error output signal is possible from all each protection upper and lower arm of IPM.
d) Compatible L-series package.

- 3ϕ 75A, 1200V 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-F$_O$ 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
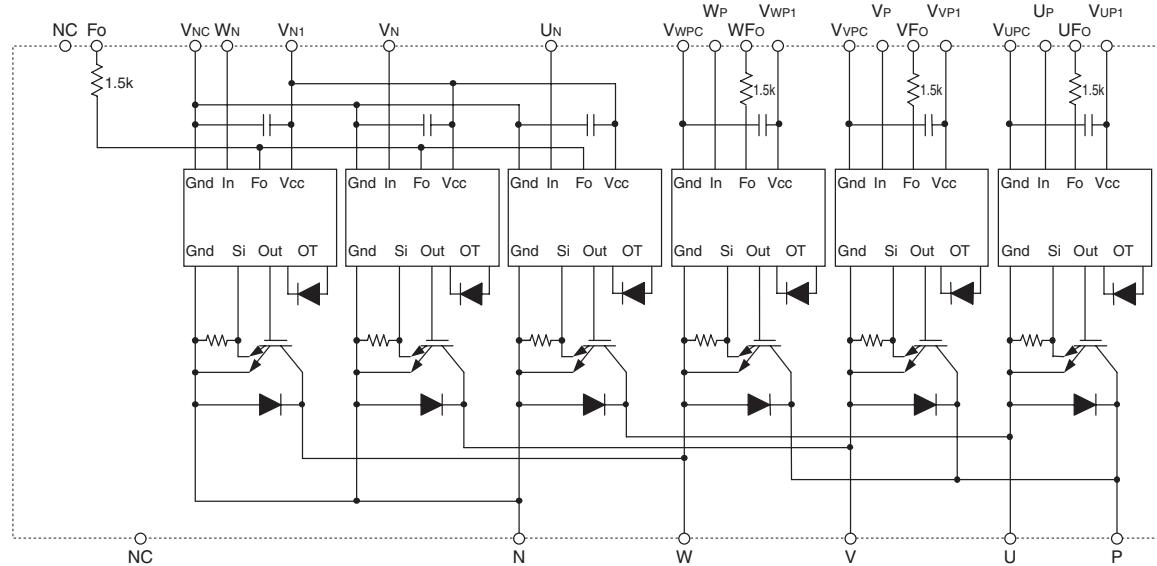
INTERNAL FUNCTIONS BLOCK DIAGRAM

MAXIMUM RATINGS (Tj = 25°C, unless otherwise noted)

INVERTER PART

Symbol	Parameter	Condition		Ratings	Unit
V_{CES}	Collector-Emitter Voltage	V_D = 15V, V_{CIN} = 15V		1200	V
±I_C	Collector Current	T_C = 25°C	(Note-1)	75	A
±I_{CP}	Collector Current (Peak)	T_C = 25°C		150	A
P_C	Collector Dissipation	T_C = 25°C	(Note-1)	595	W
T_j	Junction Temperature			−20 ~ +150	°C

*: T_C 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

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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	800	V
$V_{CC(surge)}$	Supply Voltage (Surge)	Applied between : P-N, Surge value	1000	V
T_{stg}	Storage Temperature		−40 ~ +125	°C
V_{iso}	Isolation Voltage	60Hz, Sinusoidal, Charged part to Base, AC 1 min.	2500	V_{rms}
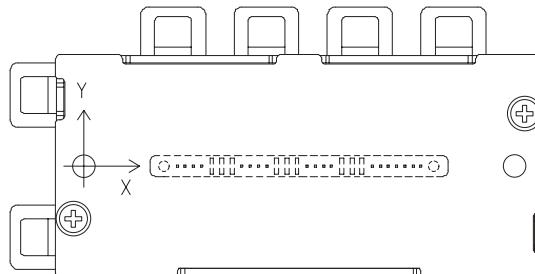
THERMAL RESISTANCES

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)	—	—	0.21	°C/W
$R_{th(j-c)F}$		Inverter FWDi part (per 1 element)	(Note-1)	—	—	0.36	
$R_{th(c-f)}$	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) T_C (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	27.8	27.8	65.4	65.4	87.4	87.4	38.7	38.7	54.5	54.5	76.5	76.5
Y	−8.0	1.0	−8.0	1.0	−8.0	1.0	7.6	−1.4	7.6	−1.4	7.6	−1.4

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 = 75A	T_j = 25°C	—	1.65	2.15	V
		V_{CIN} = 0V, Pulsed (Fig. 1)	T_j = 125°C	—	1.85	2.35	
V_{EC}	FWDi Forward Voltage	$-I_C$ = 75A, V_D = 15V, V_{CIN} = 15V (Fig. 2)		—	2.3	3.3	V
t_{on}	Switching Time	V_D = 15V, V_{CIN} = 0V↔15V V_{CC} = 600V, I_C = 75A T_j = 125°C Inductive Load (Fig. 3,4)		0.3	0.8	2.0	μs
t_{rr}				—	0.3	0.8	
$t_{c(on)}$				—	0.4	1.0	
t_{off}				—	1.2	2.8	
$t_{c(off)}$				—	0.4	1.2	
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	

CONTROL PART

Symbol	Parameter	Condition		Limits			Unit
				Min.	Typ.	Max.	
I_D	Circuit Current	$V_D = 15V$, $V_{CIN} = 15V$	V_{N1}-V_{NC}	—	6	12	mA
			$V*_{P1}$-$V*_{PC}$	—	2	4	
$V_{th(ON)}$	Input ON Threshold Voltage	Applied between : U_P-V_{UPC}, V_P-V_{VPC}, W_P-V_{WPC}		1.2	1.5	1.8	V
$V_{th(OFF)}$	Input OFF Threshold Voltage	$U_N \cdot V_N \cdot W_N$-V_{NC}		1.7	2.0	2.3	
SC	Short Circuit Trip Level	$-20 \leq T_j \leq 125°C$, $V_D = 15V$	(Fig. 3,6)	150	—	—	A
$t_{off(SC)}$	Short Circuit Current Delay Time	$V_D = 15V$	(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	$-20 \leq T_j \leq 125°C$	Trip level	11.5	12.0	12.5	V
UV_r			Reset level	—	12.5	—	
$I_{FO(H)}$	Fault Output Current	$V_D = 15V$, $V_{CIN} = 15V$	(Note-2)	—	—	0.01	mA
$I_{FO(L)}$				—	10	15	
t_{FO}	Minimum Fault Output Pulse Width	$V_D = 15V$	(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.
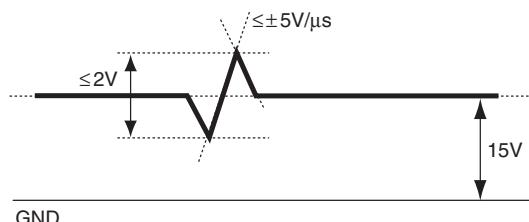
MECHANICAL RATINGS AND CHARACTERISTICS

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	N • m
—	Weight	—		—	380	—	g

RECOMMENDED CONDITIONS FOR USE
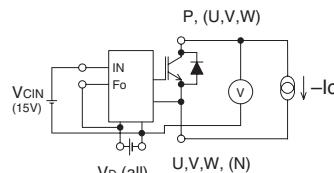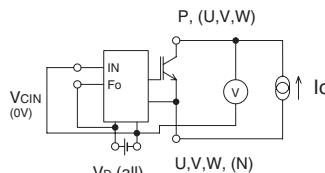
Symbol	Parameter	Condition	Recommended value	Unit
V_{CC}	Supply Voltage	Applied across P-N terminals	≤ 800	V
V_D	Control Supply Voltage	Applied between : V_{UP1}-V_{UPC}, V_{VP1}-V_{VPC} V_{WP1}-V_{WPC}, V_{N1}-V_{NC} (Note-3)	15.0 ± 1.5	V
$V_{CIN(ON)}$	Input ON Voltage	Applied between : U_P-V_{UPC}, V_P-V_{VPC}, W_P-V_{WPC}	≤ 0.8	V
$V_{CIN(OFF)}$	Input OFF Voltage	$U_N \cdot V_N \cdot W_N$-V_{NC}	≥ 9.0	
f_{PWM}	PWM Input Frequency	Using Application Circuit of Fig. 8	≤ 20	kHz
t_{dead}	Arm Shoot-through Blocking Time	For IPM's each input signals (Fig. 7)	≥ 2.5	µs

(Note-3) With ripple satisfying the following conditions: dv/dt swing $\leq \pm5V/µs$, Variation $\leq 2V$ peak to peak
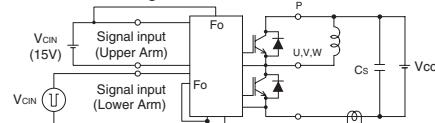
PRECAUTIONS FOR TESTING

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
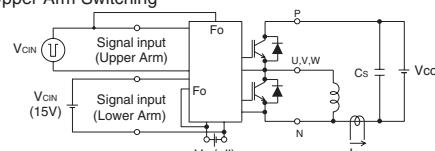
Fig. 3 Switching Time and SC Test Circuit
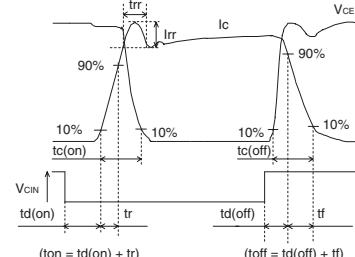
Fig. 4 Switching Time Test Waveform

$(t_{on} = t_{d(on)} + t_r)$ $(t_{off} = t_{d(off)} + t_f)$
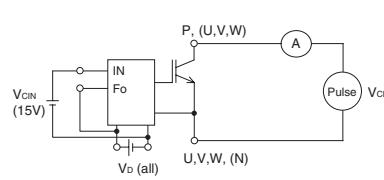
Fig. 5 I_{CES} Test
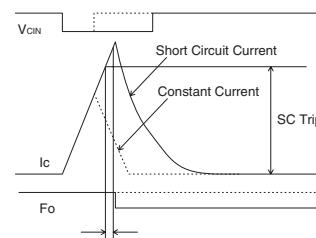
Fig. 6 SC Test Waveform

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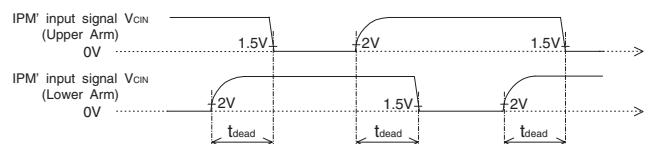
1.5V: Input on threshold voltage $V_{th(on)}$ typical value, 2V: Input off threshold voltage $V_{th(off)}$ typical value
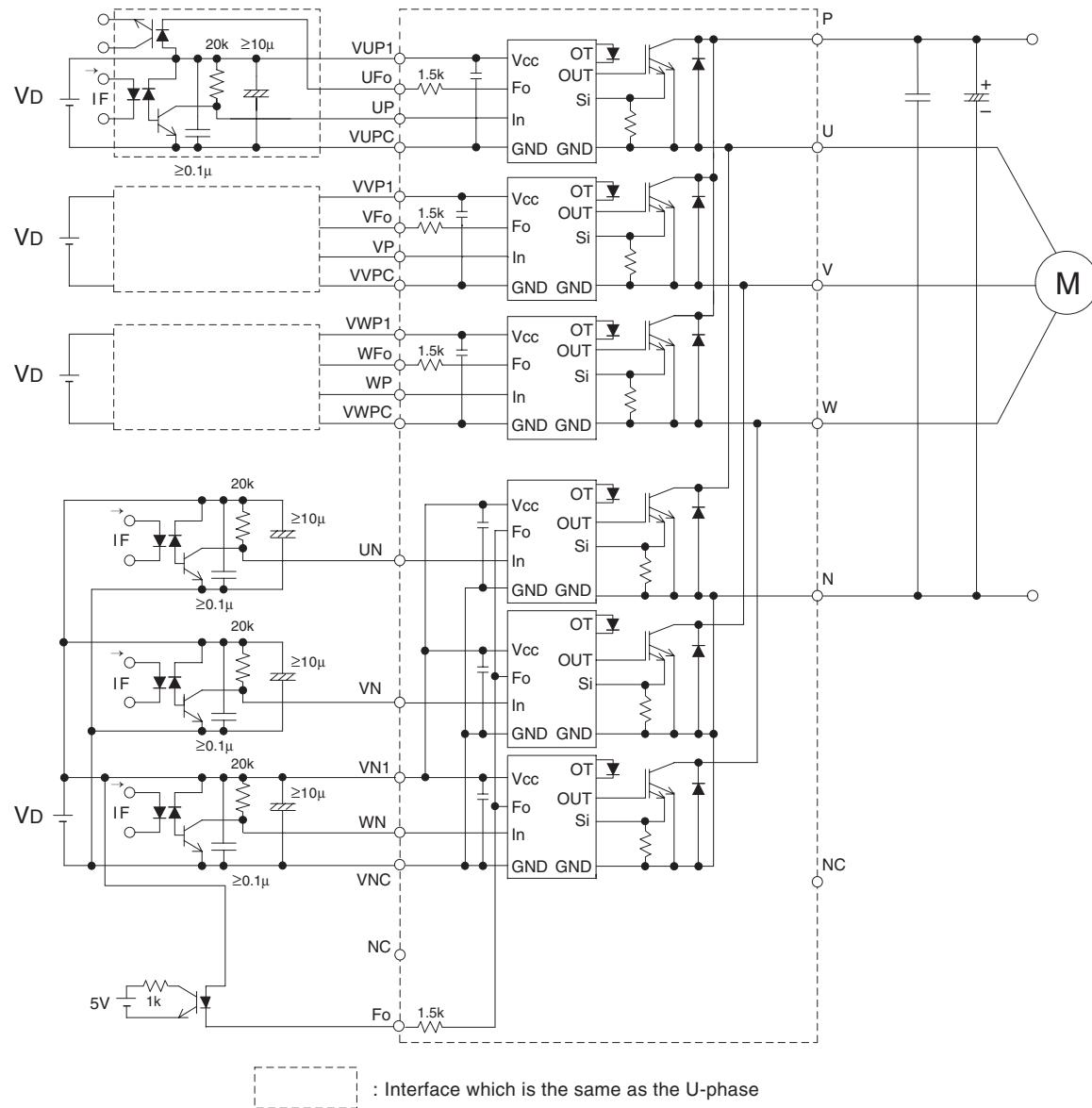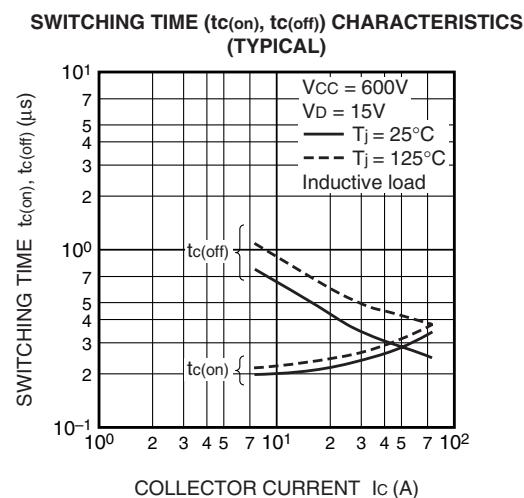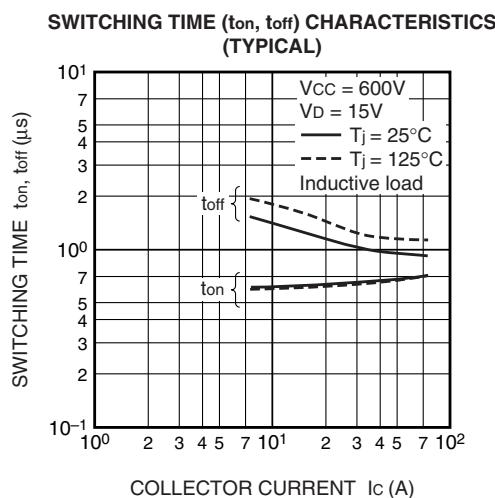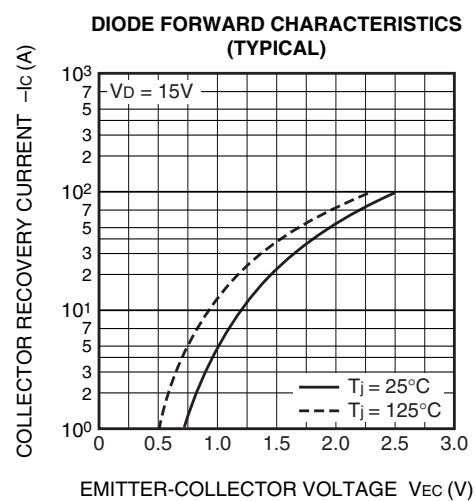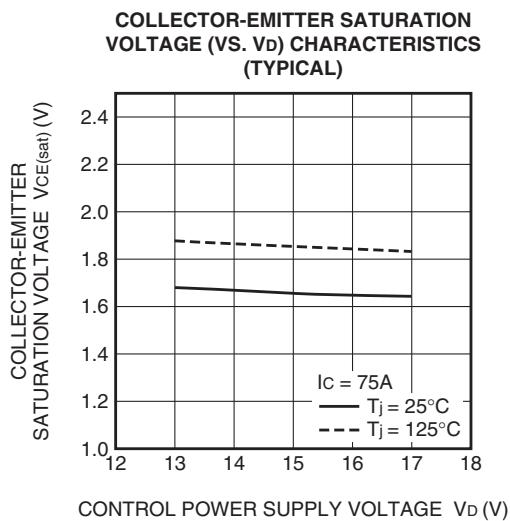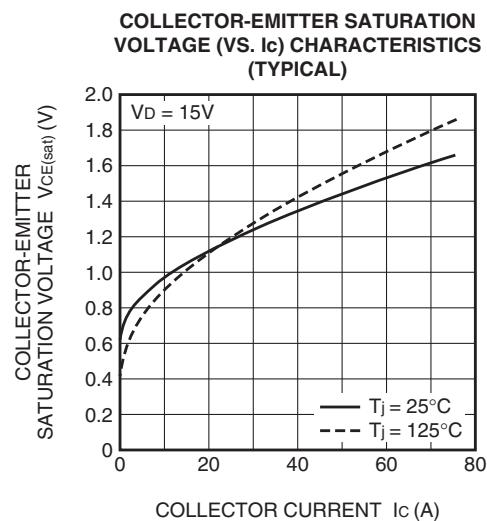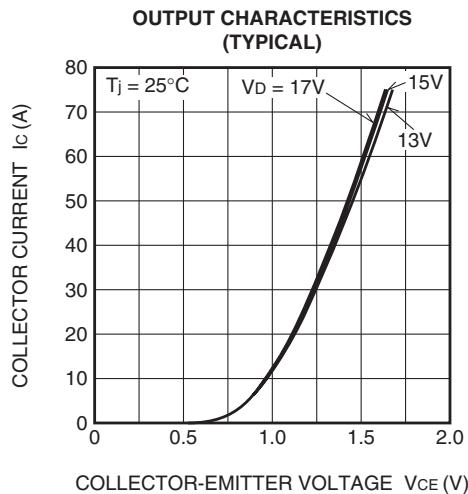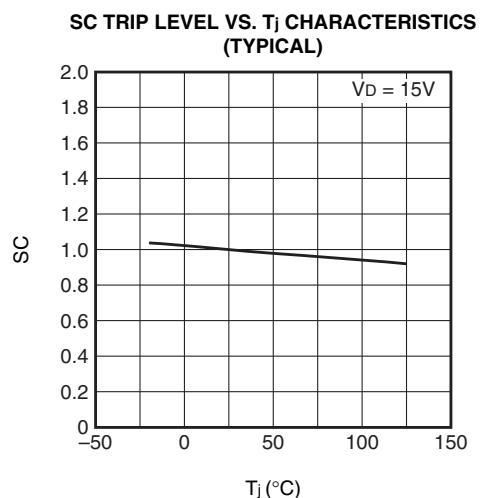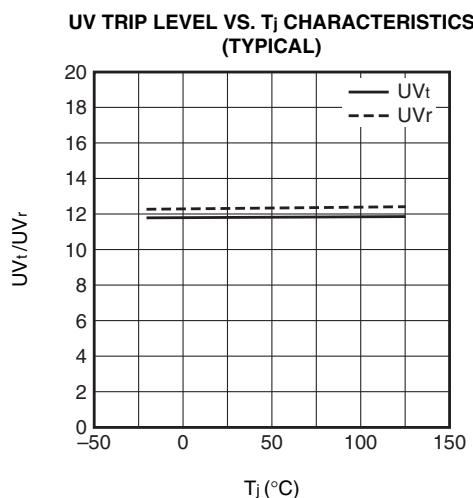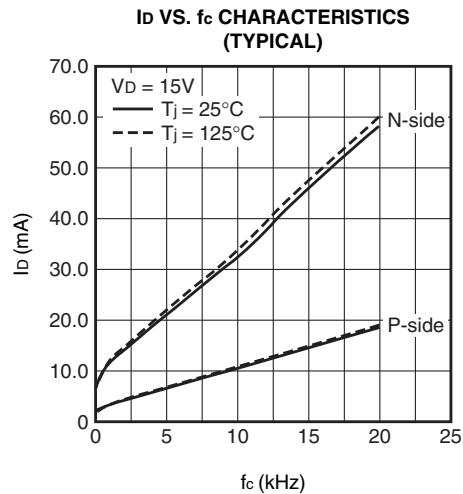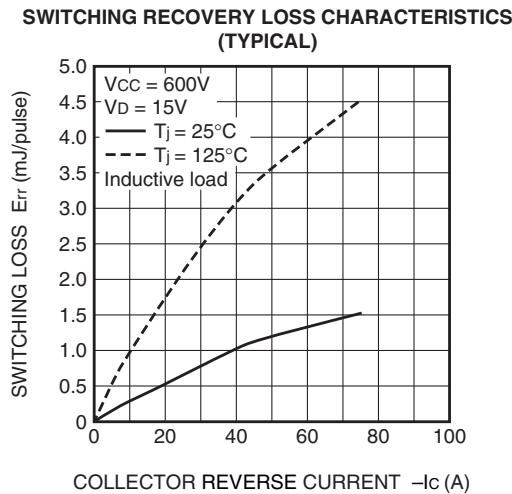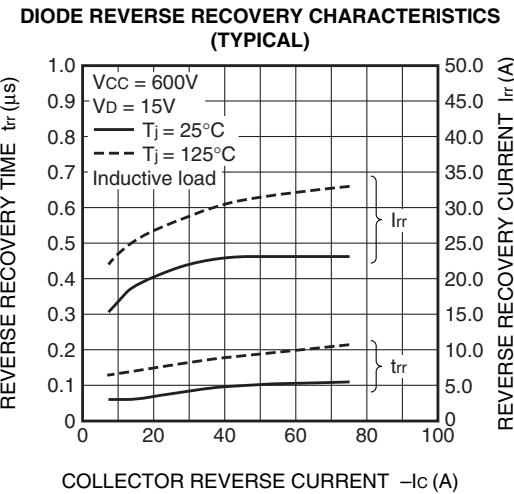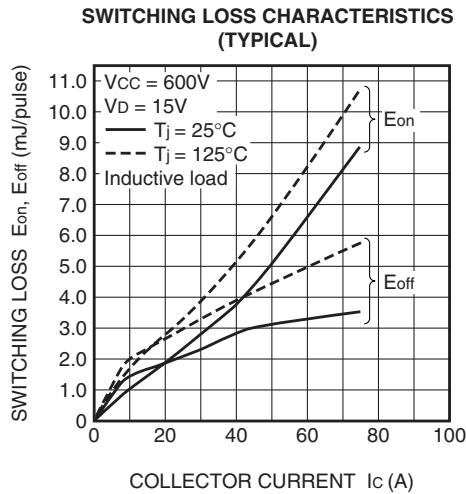
Fig. 8 Application Example Circuit

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.

PM75CL1A120

**FLAT-BASE TYPE**
INSULATED PACKAGE

PERFORMANCE CURVES

OUTPUT CHARACTERISTICS (TYPICAL)

COLLECTOR CURRENT I_C (A) vs COLLECTOR-EMITTER VOLTAGE V_{CE} (V)

Tj = 25°C, V_D = 17V, 15V, 13V

COLLECTOR-EMITTER SATURATION VOLTAGE (VS. Ic) CHARACTERISTICS (TYPICAL)

COLLECTOR-EMITTER SATURATION VOLTAGE $V_{CE(sat)}$ (V) vs COLLECTOR CURRENT I_C (A)

V_D = 15V
Tj = 25°C
Tj = 125°C

COLLECTOR-EMITTER SATURATION VOLTAGE (VS. VD) CHARACTERISTICS (TYPICAL)

COLLECTOR-EMITTER SATURATION VOLTAGE $V_{CE(sat)}$ (V) vs CONTROL POWER SUPPLY VOLTAGE V_D (V)

I_C = 75A
Tj = 25°C
Tj = 125°C

DIODE FORWARD CHARACTERISTICS (TYPICAL)

COLLECTOR RECOVERY CURRENT $-I_C$ (A) vs EMITTER-COLLECTOR VOLTAGE V_{EC} (V)

V_D = 15V
Tj = 25°C
Tj = 125°C

SWITCHING TIME (t_{on}, t_{off}) CHARACTERISTICS (TYPICAL)

SWITCHING TIME t_{on}, t_{off} (µs) vs COLLECTOR CURRENT I_C (A)

V_{CC} = 600V
V_D = 15V
Tj = 25°C
Tj = 125°C
Inductive load
t_{off}
t_{on}

SWITCHING TIME ($t_{c(on)}$, $t_{c(off)}$) CHARACTERISTICS (TYPICAL)

SWITCHING TIME $t_{c(on)}$, $t_{c(off)}$ (µs) vs COLLECTOR CURRENT I_C (A)

V_{CC} = 600V
V_D = 15V
Tj = 25°C
Tj = 125°C
Inductive load
$t_{c(off)}$
$t_{c(on)}$

May 2009

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SWITCHING LOSS CHARACTERISTICS
(TYPICAL)

V_{CC} = 600V
V_D = 15V
—— T_j = 25°C
---- T_j = 125°C
Inductive load

E_{on}
E_{off}

SWITCHING LOSS E_{on}, E_{off} (mJ/pulse)

COLLECTOR CURRENT I_C (A)

DIODE REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)

V_{CC} = 600V
V_D = 15V
—— T_j = 25°C
---- T_j = 125°C
Inductive load

I_{rr}
t_{rr}

REVERSE RECOVERY TIME t_{rr} (µs)
REVERSE RECOVERY CURRENT I_{rr} (A)

COLLECTOR REVERSE CURRENT $-I_C$ (A)

SWITCHING RECOVERY LOSS CHARACTERISTICS
(TYPICAL)

V_{CC} = 600V
V_D = 15V
—— T_j = 25°C
---- T_j = 125°C
Inductive load

SWITCHING LOSS E_{rr} (mJ/pulse)

COLLECTOR REVERSE CURRENT $-I_C$ (A)

I_D VS. f_C CHARACTERISTICS
(TYPICAL)

V_D = 15V
—— T_j = 25°C
---- T_j = 125°C

N-side
P-side

I_D (mA)

f_C (kHz)

UV TRIP LEVEL VS. T_j CHARACTERISTICS
(TYPICAL)

—— UV_t
---- UV_r

UV_t/UV_r

T_j (°C)

SC TRIP LEVEL VS. T_j CHARACTERISTICS
(TYPICAL)

V_D = 15V

SC

T_j (°C)

TRANSIENT THERMAL
IMPEDANCE CHARACTERISTICS
(TYPICAL)

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

Single Pulse
IGBT part;
Per unit base = $R_{th(j-c)}Q = 0.21°C/W$
FWDi part;
Per unit base = $R_{th(j-c)}F = 0.36°C/W$

t(sec)