

1

PWM  
DC

近藤 俊一

DC  
PWM

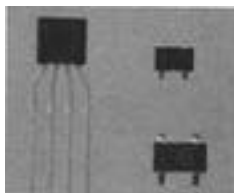
1

3 DC

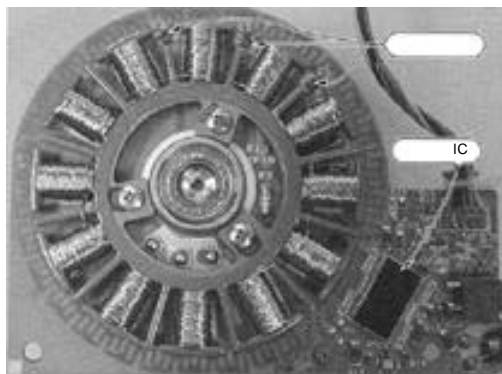
DC 가 DC ( ) DC

1. (1) 1(a) DC , 1
- 2 1

가 1 2 , 3 DC FDD(Floppy Disk Drive) DC ( ) 1(a) DC 가2 3 (U , V , W ) (LU, LV, LW) 120°



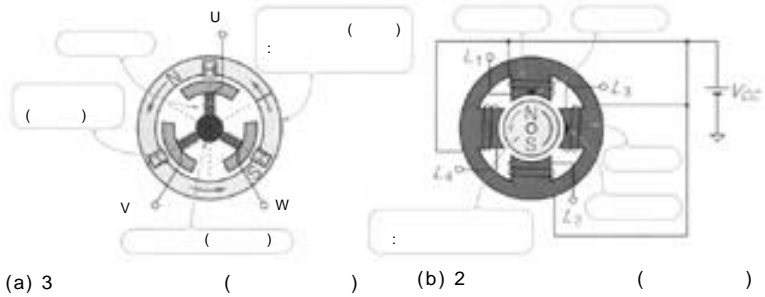
2. ( : HW-302B, : HW-108A, : HW-101A) | [旭化成電子(株)]



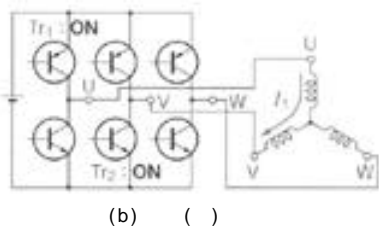
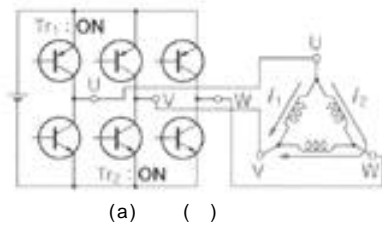
1. 3 DC [(株)三協精機]

3. FDD ( ) DC 가 )

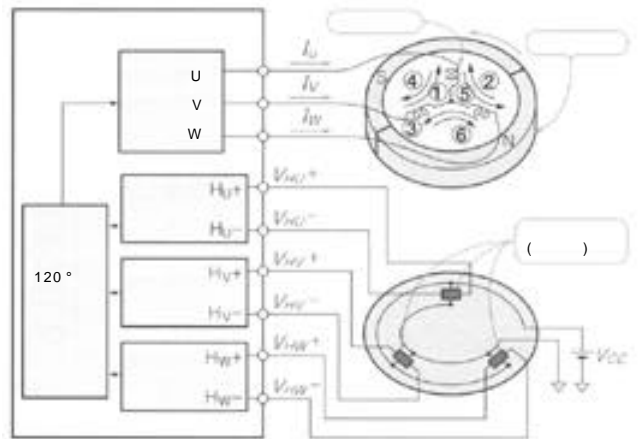
120° 3 가 (2) DC  
 3 U, V, W IU, IV, IW  
 1(a) 가 (前) 4 3 3 가  
 가 (後) (轉流)  
 2 가 6  
 2(a) 2(b) 6 (段)  
 W 가 3 U, V, 5 ( ) 5(b)  
 DC 「 ( )  
 DC 」 2



1. 3

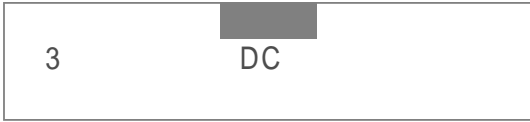


2.



3.

2 가 ,  
가 ,  
가 ,  
(torque)



DC

1.  
3 DC M63006FP  
( 4)

IC  
CD-ROM 3  
DC

2. M63006FP

(1)

6 M63006FP

(2)

6 RS

VRS

VEC,

VECR

VCT

가

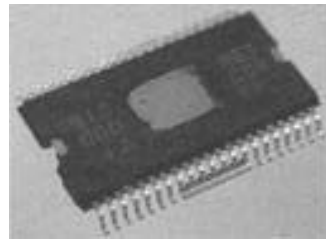
VECR>VEC

(正)

, VECR<VEC

가

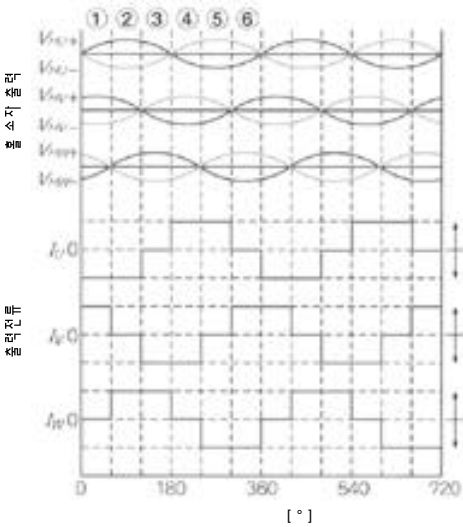
VEC



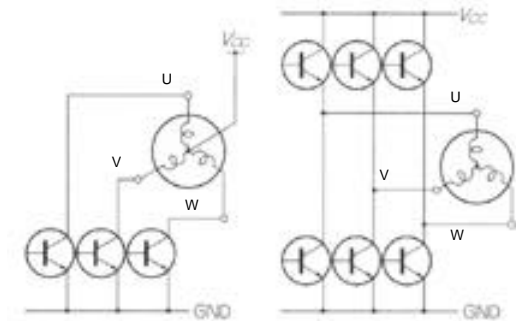
4. 3

DC  
[三菱電機(株)]

IC M63006P



4.



(a) 3

5. 3

가

가

1 M63006FP

(3)

3.

7 M63006FP

(1)

(N-I )

2 가 , M63006FP 가

N-I

12cm

CD(Compact Disc)

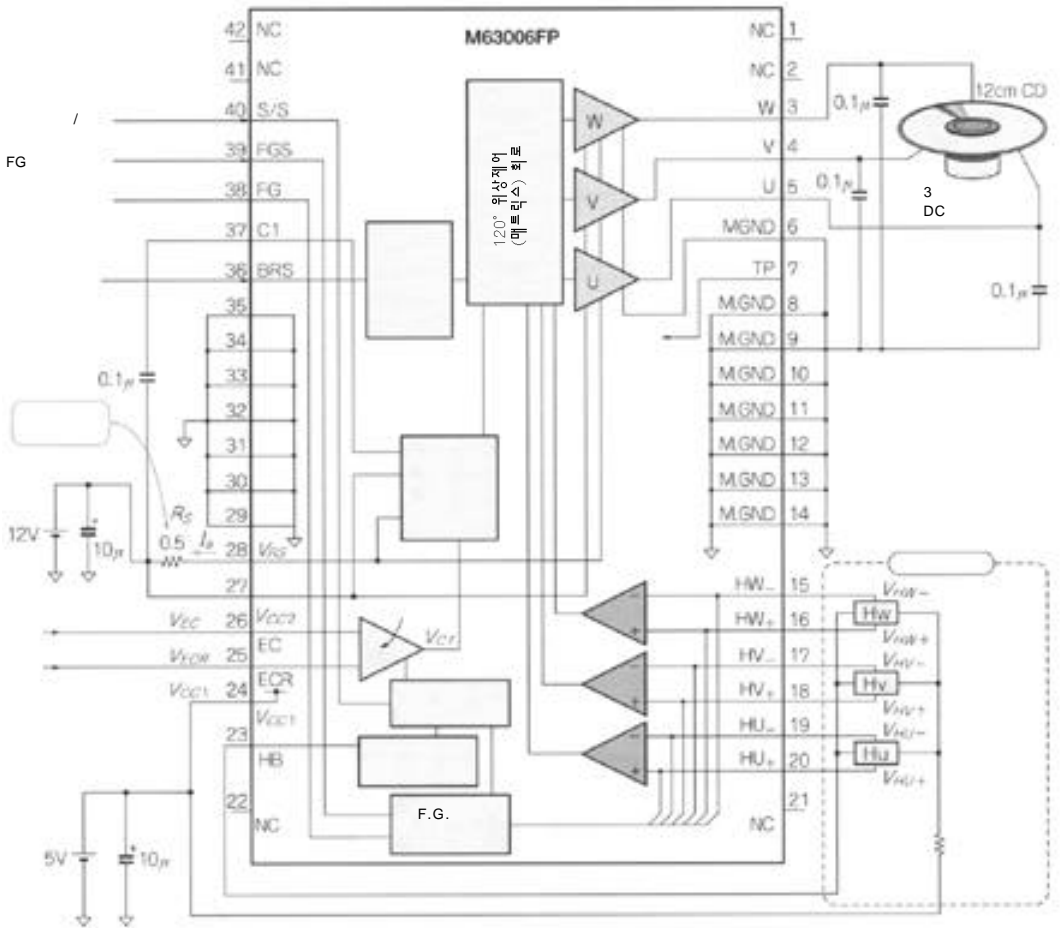
N-I

(轉流)

가

$V_{CC2}$  12V

...3



6. 3

DC

IC M63006FP

가 (8,000rpm)  
 63.2%  
 가 12cm CD  
 8  $K_e$   
 9  

$$K_e = \frac{R_s \Delta I_s}{\Delta N} = \frac{2.5 \times 0.3}{2000} = 3.8 \times 10^{-4} \text{ V/rpm}$$
  

$$m = 5.4s$$
  
 (3)  
 10 (N=8,000rpm) 3 1  
 12cm CD  
 4  
 120° : 60° :  
 120° : 60° :  
 120° :  
 0.3A  
 (2)  
 $R_a$  : [ ],  $I_a$  : [A],  
 $N$  : [rpm]  
 $R_a$   
 2.5 ( )  
 $N_0$   $I_{a0}$  12,800rpm  
 0.55A

1. M63006FP

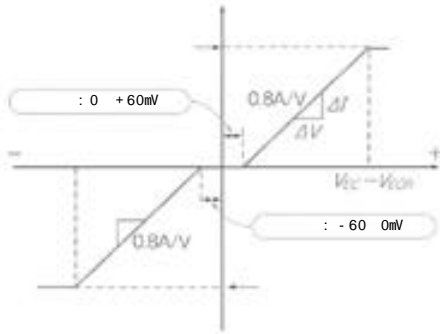
(a) ( $T_A = 25$  )

	$V_{ES}$	28	16	V
1	$V_{CC1}$	27	16	V
2	$V_{CC2}$	24	7.0	V
	$I_0$	—	1.5	A
	$V_{DS}$	15 20	4.5	V
	$P_T$		1.2	W
	$K_e$		9.6	mW/°C
	$T_J$	—	150	°C

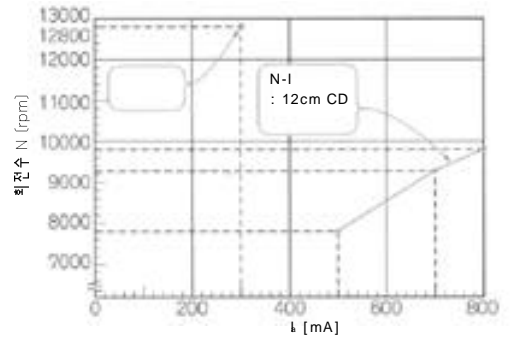
(b)

1	$I_{SLP}$	$V_{CC1}$ $V_{CC2}$ (S/S : " L " Hi-Z)	—	—	10	$\mu$ A
	$I_{CC}$	$V_{CC1}$ $V_{CC2}$ ( $V_{EC} = V_{ECR} = 1.5V$ , S/S : " H ")	—	—	10	mA
	$V_{DS}$	( $I_0 = 0.5A$ )	—	1.2	1.9	V
	$V_{EC+}$	$V_{EC} < V_{ECR}$	-60	-30	0	mV
	$V_{EC-}$	$V_{EC} > V_{ECR}$	0	+30	+60	mV
	$V_{ECR}$	25	0	1.65	3.3	V
	$V_{EC}$	26	0	1.65	3.3	V
	$G_{SD}$	$I_0 = G_{SD}/R_{DS(on)}$	0.34	0.4	0.45	V/V
	$V_{DS(on)}$	$I_{DS} = V_{DS}/R_{DS(on)}$	0.27	0.3	0.33	V
	$V_{DS(on)}$	15 20	1.3	—	( $V_{CC1} = -1.3$ )	V
	$V_{DS(on)}$	15 20	60	—	—	mV $_{P-P}$

$V_{CC1} = 5V$ ,  $V_{CC2} = 12V$ ,  $T_A = 25$

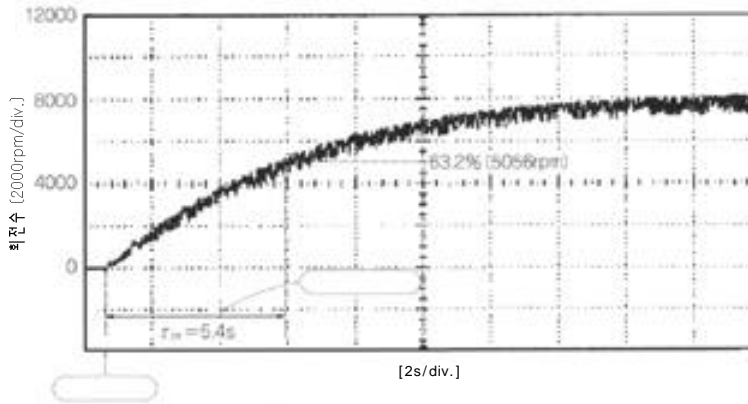


7. M63006FP

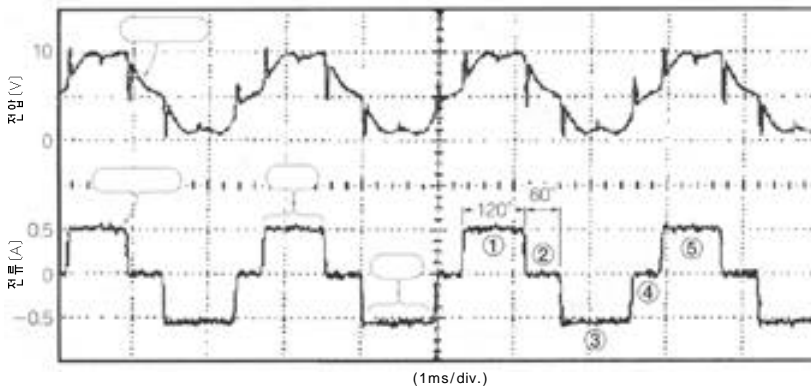


$R_s = 2.5$  : 12800rpm  
 $300mA$  :  $K_s = 3.8 \times 10^{-4} V / krpm$

8. 3 DC N-I

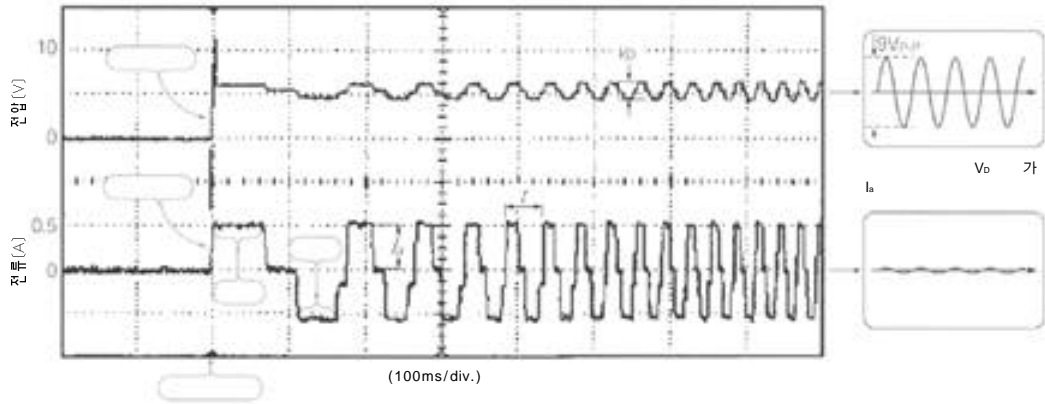


9. DC 3 m

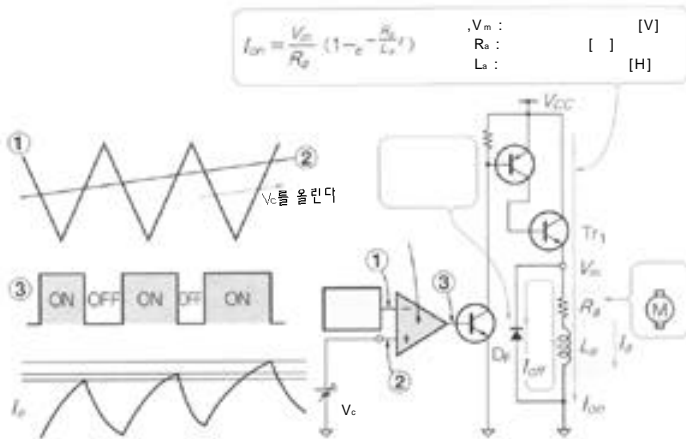


10.

(4) 120° 가 ( )  
 11 800ms VD  
 IC  $V_D = R_a I_a = 2.5 \times 0.55 = 1.4 V_{p-p}$   
 가  
 t가 11 800ms  
 가 가 (120° 60°) 가 ,  $V_D$   
 가 ,  
 VD  $V_D$ 가



11.



12. PWM

PWM

$$\tau_c = \frac{R_a}{L_a}$$

PWM

DC

가

2. 3

DC PWM

1. PWM  
(1)

M63013FP( 5)  
3

PWM(Pulse Width Modulation)

DC PWM

12 PWM  
PWM

13 3 DC  
(M63013FP )  
PWM 12 PWM

( )  
Tr<sub>1</sub> ON/OFF  
V<sub>c</sub>

I<sub>a</sub>

가

14

(段)

13 3

Tr<sub>1</sub> ON I<sub>on</sub> Tr<sub>1</sub>  
OFF ON

( (上) )

ON PWM

(free wheeling diode) DF

I<sub>off</sub>가

C<sub>osc</sub>

가 ON

ON

Tr<sub>1</sub> OFF  
L<sub>a</sub>

R<sub>s</sub>

가

PWM

가가

(2)  
PWM

I<sub>on</sub> Tr<sub>1</sub>

I<sub>on</sub>

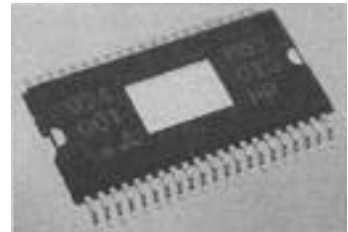
가

가

(N=0) 가

L<sub>a</sub>

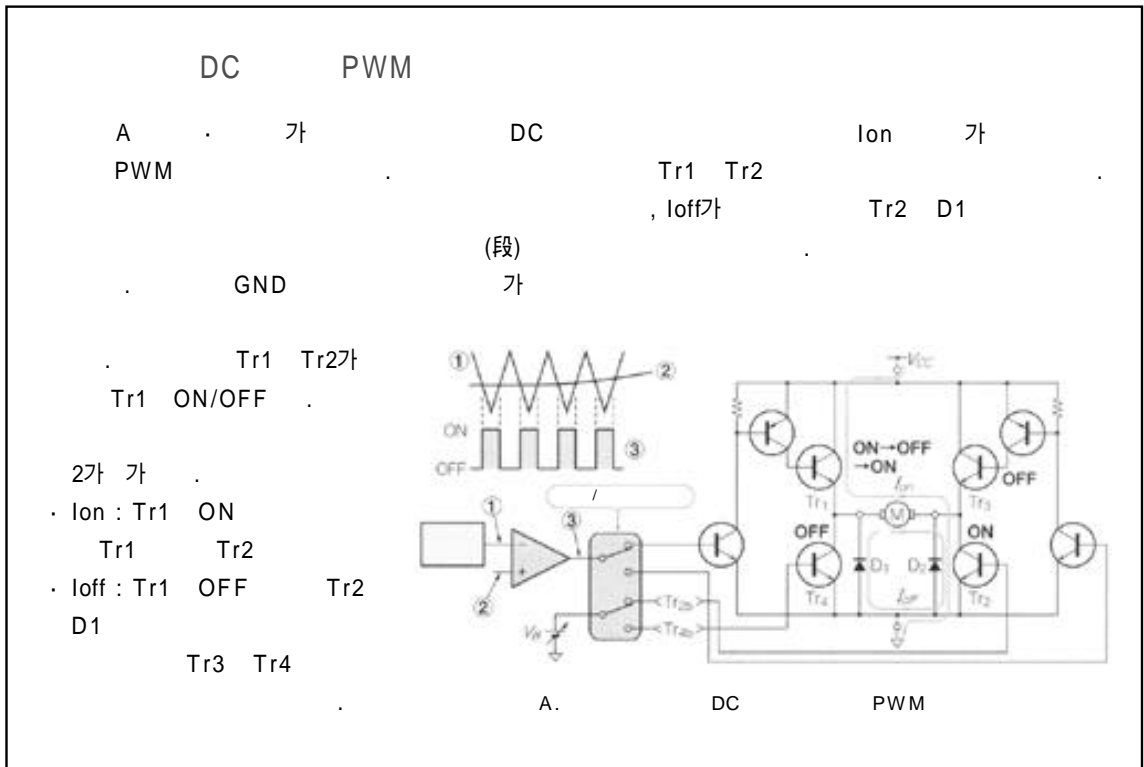
R<sub>a</sub>

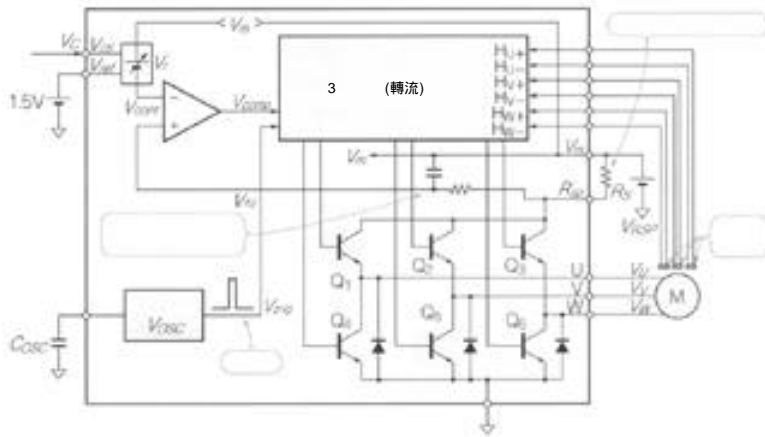


5. 3 DC  
PWM IC M63013FP  
[三菱電機(株)]

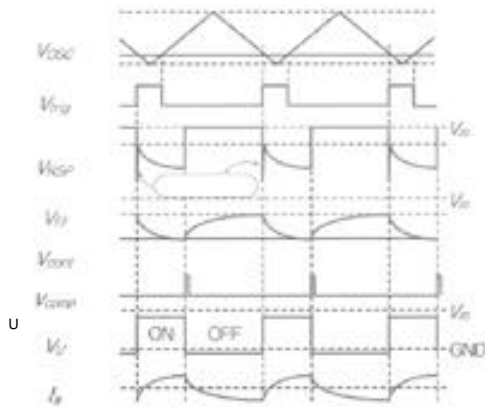


가 .  
 $V_{cont}$ 가  
 $I_a$ 가  $V_{cont}$ 가  $R_s$ 가 PWM  
 (上) ON OFF ( : wow and flutter)  
 가  
 15 U (上)  $Q_1$  V (下)  $Q_5$  3.  
 가 PWM PWM 가  
 14 U ( ) ON 가  
 $I_{on}$ , OFF  $I_{off}$  17 T-N  
 (上) OFF (下) 0.05kgf cm  
 $I_a$  16 ,  $I_a$ 가  $R_a = 10$   
 $I_{cont}(=V_c/R_s)$   $Q_1$   $I_a = 0.71A$  ( 0.05kgf m T-I  
 ON  $I_{on}$  )  
 $Q_1$  OFF ,  $I_{off}$  가  $I_{off}$   $V_M = 12V$   
 , PWM  $I_{on}$  (1)

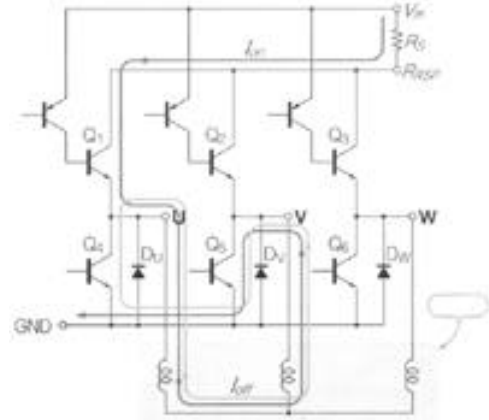




13.3 DC M63013FP PWM



14. PWM



15. PWM

18

$V_{I(lin)}$

$V_{m(lin)}$

$V_{m(lin)} = I_a R_a = 7.1V$

$V_{I(lin)} = V_m - V_{m(lin)} = 4.9V$

$P_{D(lin)}$

$P_{D(lin)} = V_{I(lin)} I_a = 3.48W$

(2) PWM

15

PWM

274

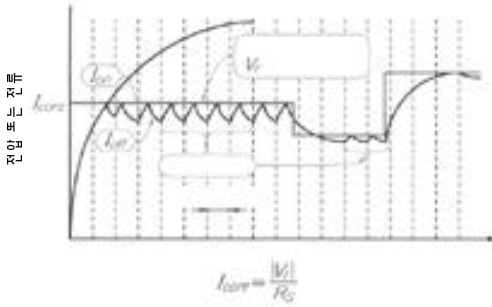
ON

$Q_1, Q_5$ 가 ON

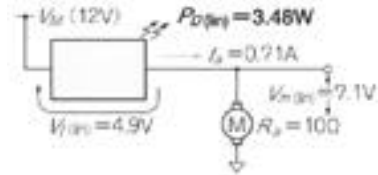
$P_{D1}$

1

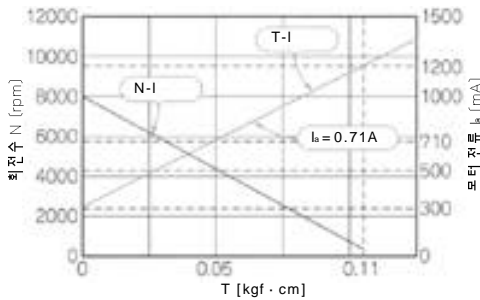
I  
C



16. PWM



18.



17.

3

DC

T-N

T-I

- \$R\_a = 2.5\$
- \$K\_e = 0.00125V/rpm\$
- \$: 0.11kgf \cdot cm\$
- \$: 300mA\$
- \$: 12800rpm\$
- \$: 12mA\$

$$P_{D1} = (V_{Q1(sat)} + V_{Q2(sat)}) I_a$$

, \$V\_{Q1(sat)}\$ : \$Q\_1\$ [V], \$V\_{Q2(sat)}\$ : 가

\$Q\_2\$ [V], \$I\_a\$ : [A]

\$Q\_1\$ OFF

$$V_{Q1(sat)} = 1.0V, V_{Q2(sat)} = 0.2V, V_F = 0.5V$$

, \$P\_{D1} = 0.85W, P\_{D2} = 0.5W\$

$$P_{D(PWM)} = 0.68W$$

\$D\_U, Q\_5\$

\$P\_{D2}\$

$$P_{D2} = (V_{Q5(sat)} + V_F) I_a$$

, \$V\_F\$ : [V]

가 . 가

\$I\_a\$가

가 . PWM

가 .

50% . , \$P\_{D(PWM)}\$

PWM

$$P_{D(PWM)} = 0.5P_{D1} + 0.5P_{D2}$$



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