

TOSHIBA INTELLIGENT POWER MODULE SILICON N CHANNEL IGBT

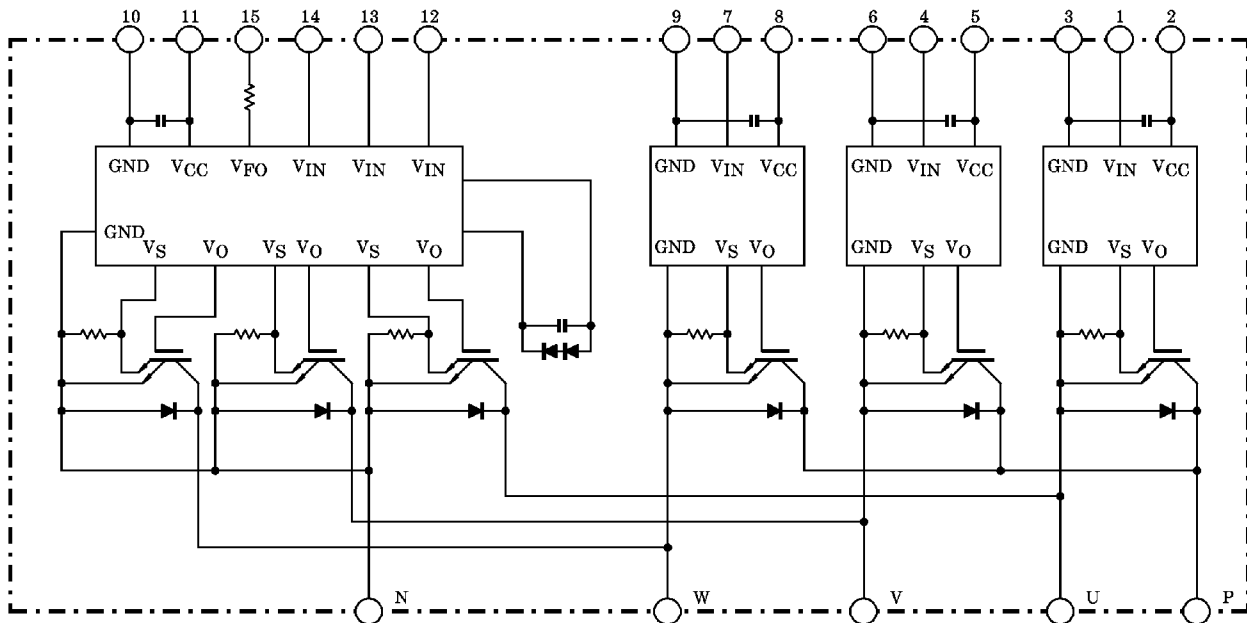
# MIG30J103H

HIGH POWER SWITCHING APPLICATIONS

MOTOR CONTROL APPLICATIONS

- Intelligent Power Module that include IGBT drive circuits, overcurrent, undervoltage lockout, and overtemperature protection.
- The Electrodes are Isolated from Case.
- High speed type IGBT :  $V_{CE(sat)}=2.7V$  (MAX.)  
 $t_{off}=2.0\mu s$  (MAX.)  
 $t_{rr}=0.25\mu s$  (MAX.)
- Outline : TOSHIBA 2-99E1A (See page 5 for the device outline)
- Weight : 80g

EQUIVALENT CIRCUIT



- |               |               |               |
|---------------|---------------|---------------|
| 1. $V_{INU}$  | 2. $V_{DU}$   | 3. $GND_U$    |
| 4. $V_{INV}$  | 5. $V_{DV}$   | 6. $GND_V$    |
| 7. $V_{INW}$  | 8. $V_{DW}$   | 9. $GND_W$    |
| 10. $GND_L$   | 11. $V_{DL}$  | 12. $V_{INX}$ |
| 13. $V_{INY}$ | 14. $V_{INZ}$ | 15. $V_{FO}$  |

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MAXIMUM RATINGS ( $T_j = 25^\circ\text{C}$ )

	SYMBOL	ITEM	CONDITION	RATING	UNIT
Inverter Part	$V_{CC}$	Supply Voltage	P-N	400	V
	$V_{CES}$	Collector-Emitter Voltage	—	600	V
	$\pm I_C$	Collector Current (DC)	$T_c = 25^\circ\text{C}$	30	A
	$P_C$	Collector Power Dissipation	$T_c = 25^\circ\text{C}$	83	W
	$T_j$	Junction Temperature	—	150	$^\circ\text{C}$
Control Part	$V_D$	Supply Voltage	—	20	V
	$V_{IN}$	Input Voltage	$V_{IN} = V_D$	20	V
	$V_{FO}$	Fowl Output Voltage	$V_{FO} = V_D$	20	V
	$I_{FO}$	Fowl Output Current	—	7	mA
All System	$T_c$	Operating Temperature	—	-20~+100	$^\circ\text{C}$
	$T_{stg}$	Storage Temperature Range	—	-40~+125	$^\circ\text{C}$
	$V_{ISO}$	Isolation Voltage	AC, 1 min	2500	$V_{rms}$
	—	Screw Torque	M5	2	N·m

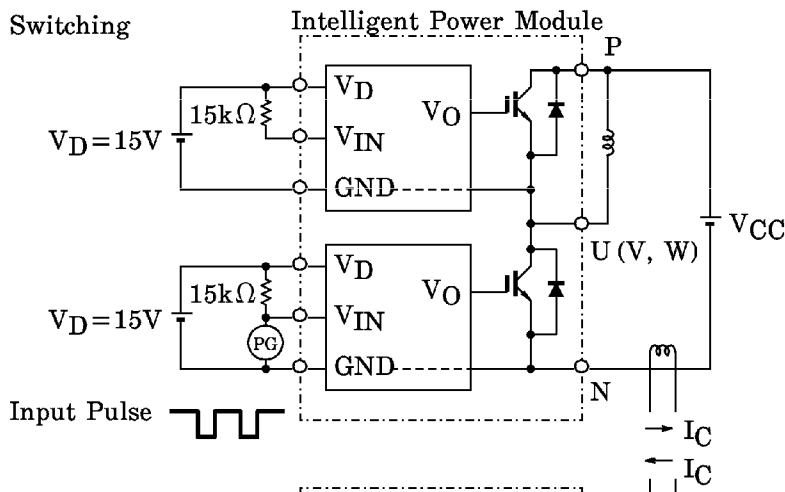
ELECTRICAL CHARACTERISTICS ( $T_j = 25^\circ\text{C}$ )

Inverter Part

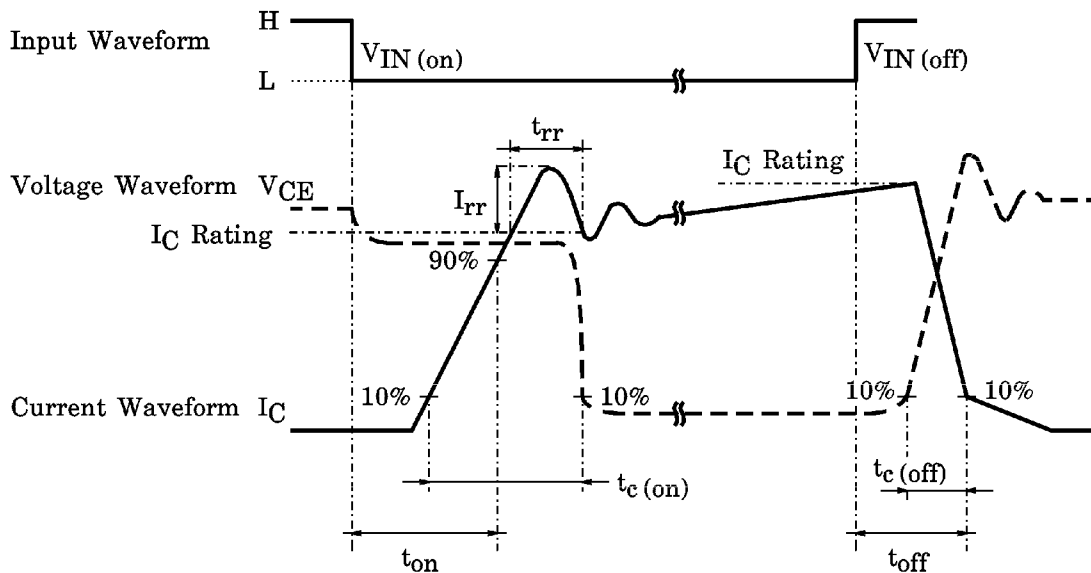
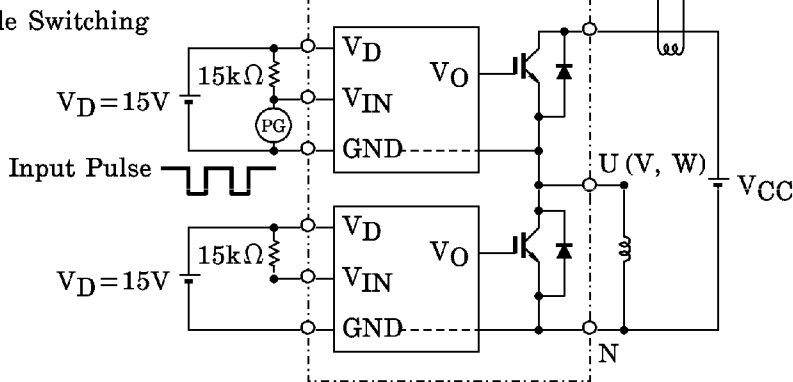
SYMBOL	ITEM	TEST CONDITION	SPEC			UNIT	
			MIN.	TYP.	MAX.		
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_D = 15\text{V}$ $I_{IN} = 0\text{mA}$	$I_C = 30\text{A}$	—	2.1	2.7	V
			$I_C = 30\text{A},$ $T_j = 125^\circ\text{C}$	—	—	3.0	
$V_F$	Forward Voltage	$I_F = 30\text{A}$	—	2.0	2.7	V	
$t_{on}$	Switching Time	$V_{CC} = 300\text{V}$ $I_C = 30\text{A}$ $V_D = 15\text{V}$ $I_{IN} = 1\text{mA} \leftrightarrow 0\text{mA}$ Inductive Load	—	0.5	1.3	2.0	$\mu\text{s}$
$t_{c(on)}$			—	—	0.3	1.0	
$t_{off}$			—	0.5	1.0	2.0	
$t_{c(off)}$			—	—	0.5	1.5	
$t_{rr}$			—	0.15	0.25	—	
$I_{CES}$	Collector Cut-off Current	$V_{CE} = 600\text{V}$	$T_j = 25^\circ\text{C}$	—	—	1	mA
			$T_j = 125^\circ\text{C}$	—	—	20	

Note 1 : Switching Time Test Circuit & Timing Chart

a) Low Side Switching



b) High Side Switching



Control Part ( $T_j = 25^\circ\text{C}$ )

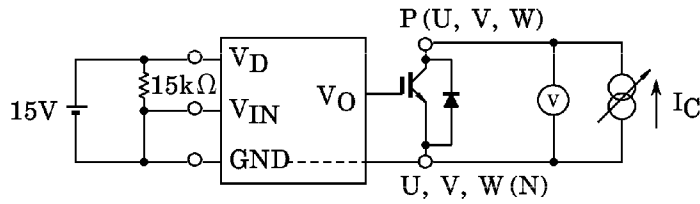
SYMBOL	ITEM	TEST CONDITION	SPEC			UNIT	
			MIN.	TYP.	MAX.		
$I_D$	Circuit Current	$V_D = 15\text{V}$	High Side	6	12	18	mA
			Low Side	11	23	35	
$V_{IN(on)}$	Input On Signal Voltage	—	1.0	1.3	1.6	V	
$V_{IN(off)}$	Input Off Signal Voltage		1.5	1.8	2.1		
$I_{FO}$	Foul Output Current (Protection)	$V_D = 15\text{V}, V_{FO} = 15\text{V}$	3	5	7	mA	
	Foul Output Current (Normal)		—	—	1		
OC	Over Current Protection Trip Level	$V_D = 15\text{V}$	46	55	—	A	
		$V_D = 15\text{V}, T_j \leq 125^\circ\text{C}$	39	—	—		
$t_{off(OC)}$	Over Current Cut Off Time	$V_D = 15\text{V}$	5	10	18	$\mu\text{s}$	
OT	Over Temperature Protection	Case Temperature	Trip Level	100	110	120	$^\circ\text{C}$
			Reset Level	80	90	100	
UV	Control Supply Under-Voltage Protection	—	Trip Level	11.3	12.0	12.7	V
UVr			Reset Level	11.8	12.5	13.2	
$t_{FO}$	Foul Output Pulse Width	$V_D = 15\text{V}$	5	10	15	ms	

Thermal Resistance ( $T_j = 25^\circ\text{C}$ )

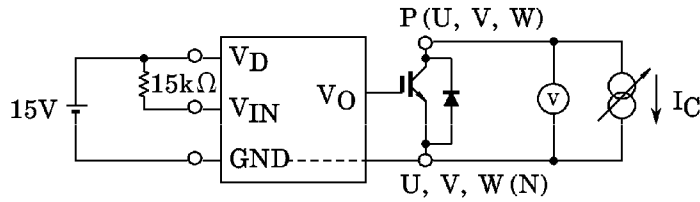
SYMBOL	ITEM	TEST CONDITION	SPEC			UNIT
			MIN.	TYP.	MAX.	
$R_{th(j-c)}$	Junction to Case Thermal Resistance	INV. IGBT	—	—	1.5	$^\circ\text{C}/\text{W}$
$R_{th(j-c)}$		INV. FWD	—	—	4.5	
$R_{th(c-f)}$	Case to Fin Thermal Resistance with compound	—	—	0.2	—	

**ELECTRICAL CHARACTERISTICS TEST CIRCUIT** ( $V_{CE(sat)}$ ,  $V_F$ ,  $I_{CES}$ ,  $I_D$ ,  $V_{IN}$ ,  $I_{FO}$ ,  $t_{FO}$ )

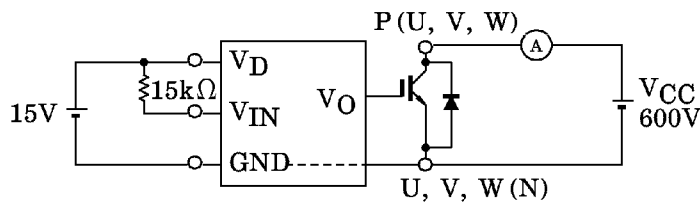
a)  $V_{CE(sat)}$



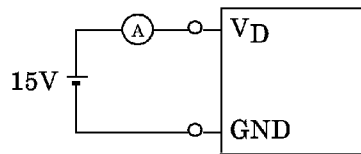
b)  $V_F$



c)  $I_{CES}$

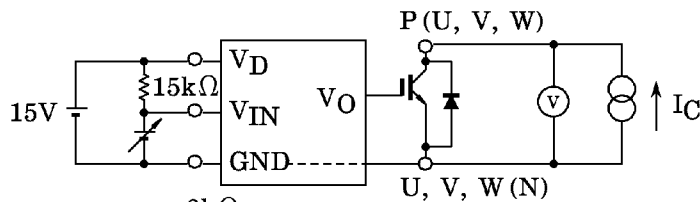


d)  $I_D$

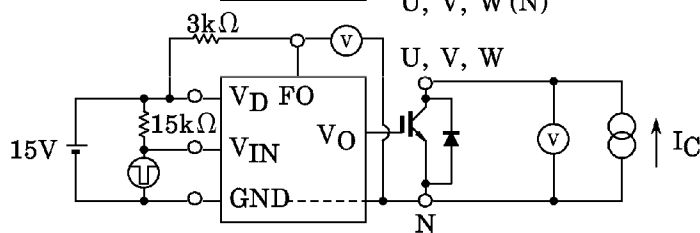


e)  $V_{IN(OFF)}$

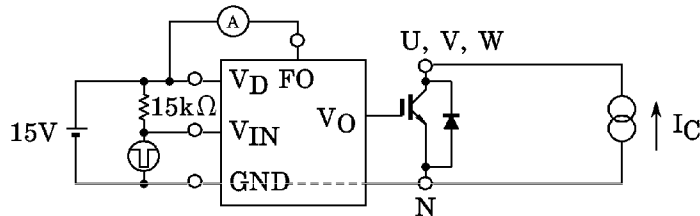
$V_{IN(ON)}$



f)  $t_{FO}$

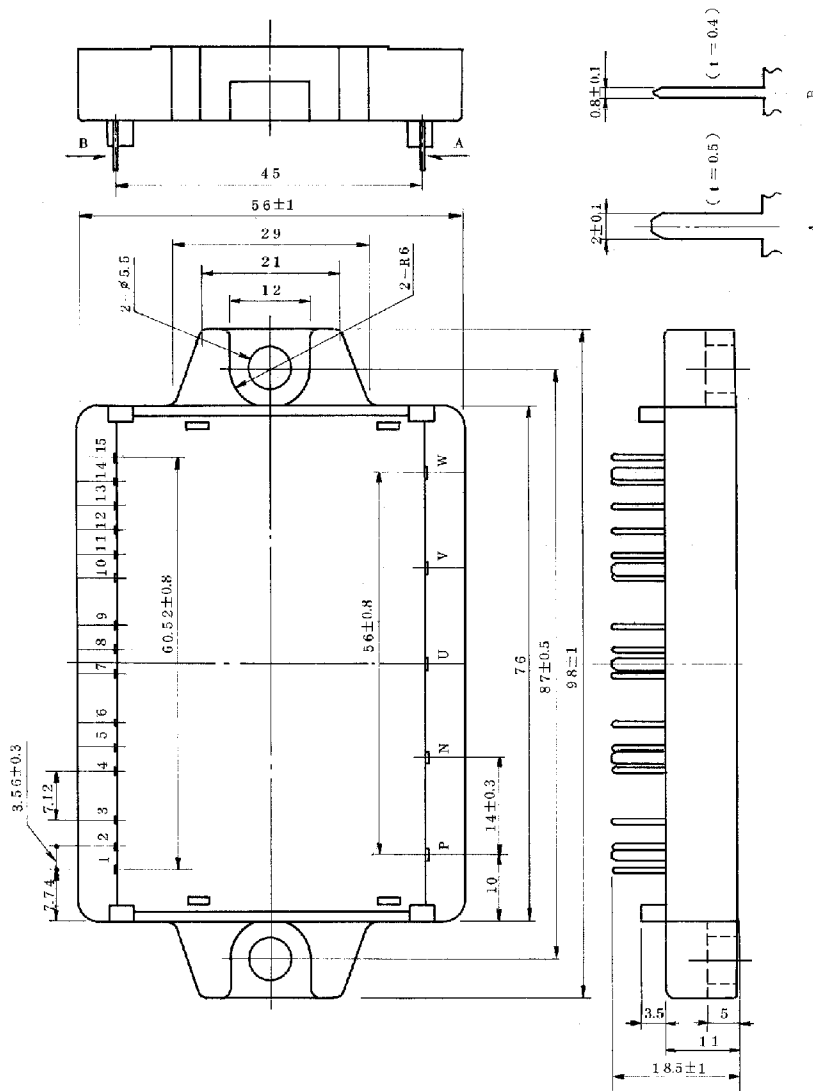


g)  $I_{FO}$



OUTLINE : TOSHIBA 2-99E1A

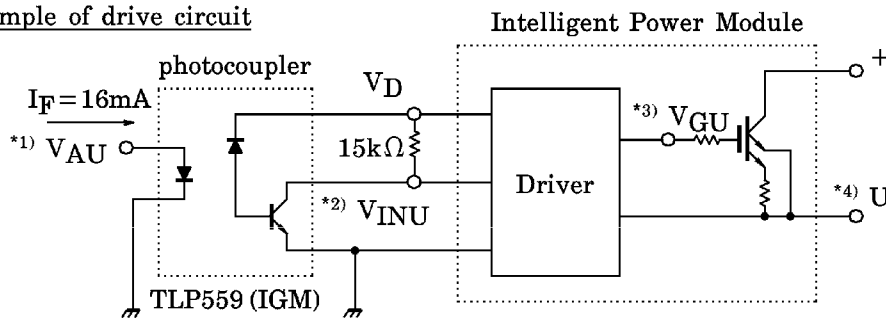
Unit in mm



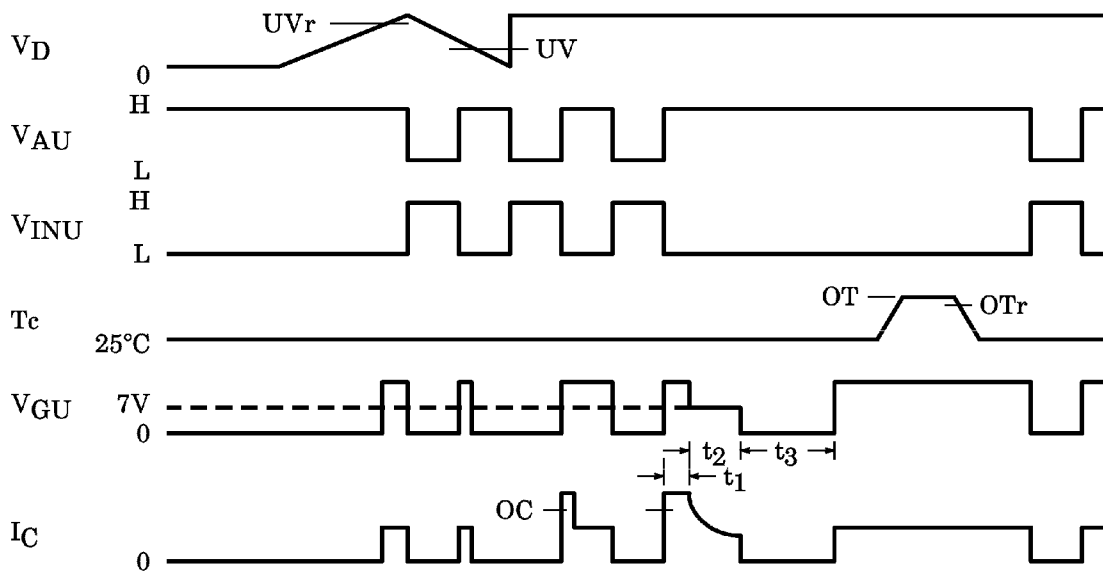
- |          |          |          |
|----------|----------|----------|
| 1. VINU  | 2. VDU   | 3. GNDU  |
| 4. VINV  | 5. VDV   | 6. GNDV  |
| 7. VINW  | 8. VDW   | 9. GNDW  |
| 10. GNDL | 11. VDL  | 12. VINX |
| 13. VINY | 14. VINZ | 15. VFO  |

TIMING CHART (High side)

Typical example of drive circuit



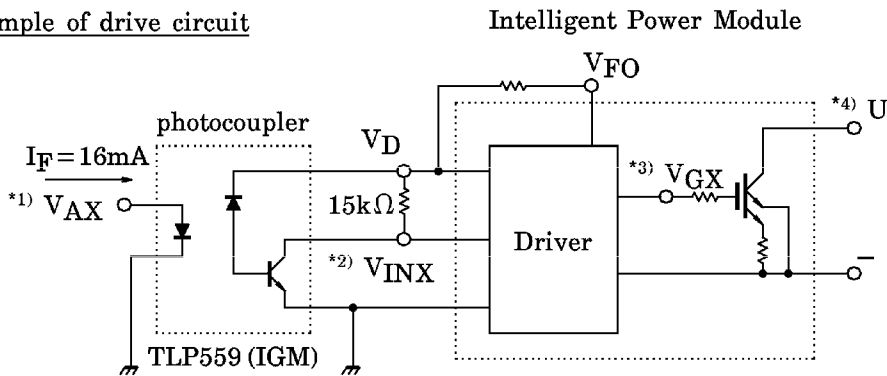
- \*1) or V<sub>AV</sub>, V<sub>AW</sub>
- \*2) or V<sub>INV</sub>, V<sub>INW</sub>
- \*3) or V<sub>GV</sub>, V<sub>GW</sub>
- \*4) or V, W



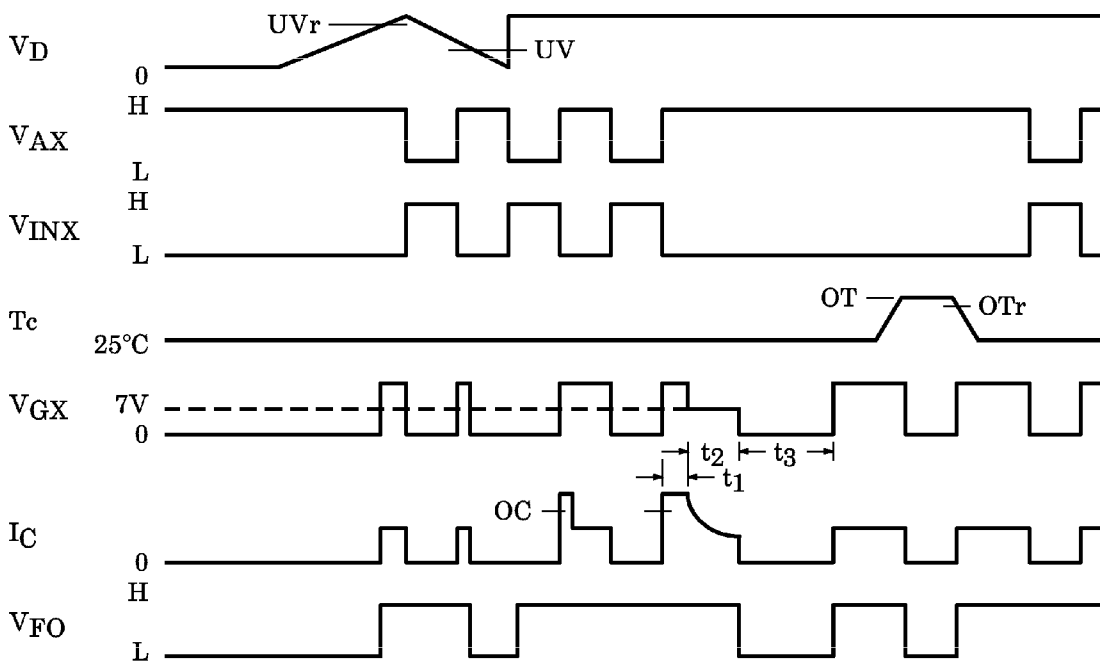
- UV : Under-Voltage Trip Level
- UVr : Under-Voltage Reset Level
- OT : Over Temperature Trip Level
- OTr : Over Temperature Reset Level
- OC : Over Current
- t<sub>1</sub> : 2.5μs (Typ.)
- t<sub>2</sub> : 10μs (Typ.)
- t<sub>3</sub> : 10ms (Typ.)

TIMING CHART (Low side)

Typical example of drive circuit



- \*1) or VAY, VAZ
- \*2) or VINY, VINZ
- \*3) or VGY, VGZ
- \*4) or V, W



- UV : Under-Voltage Trip Level
- UVr : Under-Voltage Reset Level
- OT : Over Temperature Trip Level
- OTr : Over Temperature Reset Level
- OC : Over Current
- $t_1$  :  $2.5\mu s$  (Typ.)
- $t_2$  :  $10\mu s$  (Typ.)
- $t_3$  :  $10ms$  (Typ.)



