

TOSHIBA INTELLIGENT POWER MODULE SILICON N CHANNEL IGBT

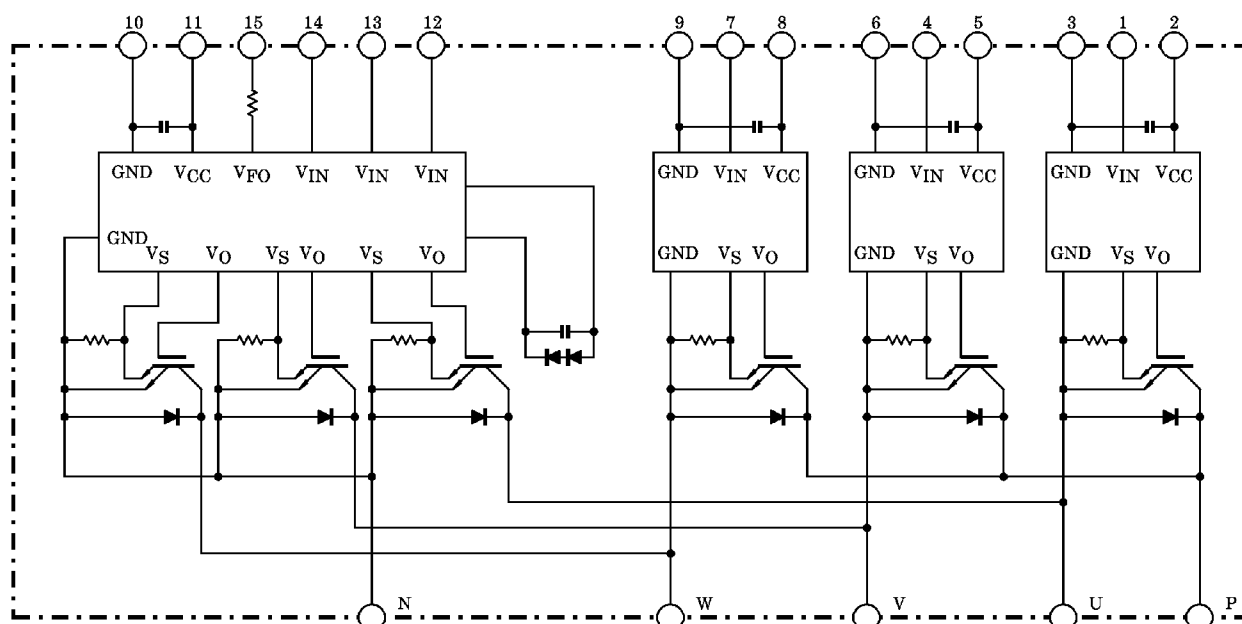
MIG30J103H

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	—	$-20 \sim +100$	$^\circ\text{C}$
	T_{stg}	Storage Temperature Range	—	$-40 \sim +125$	$^\circ\text{C}$
	V_{ISO}	Isolation Voltage	AC, 1 min	2500	V_{rms}
	—	Screw Torque	M5	2	N·m

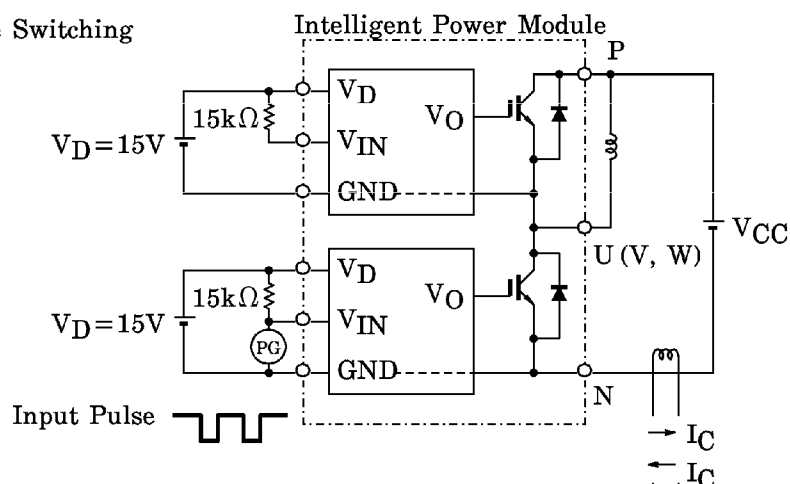
ELECTRICAL CHARACTERISTICS ($T_j = 25^\circ\text{C}$)

Inverter Part

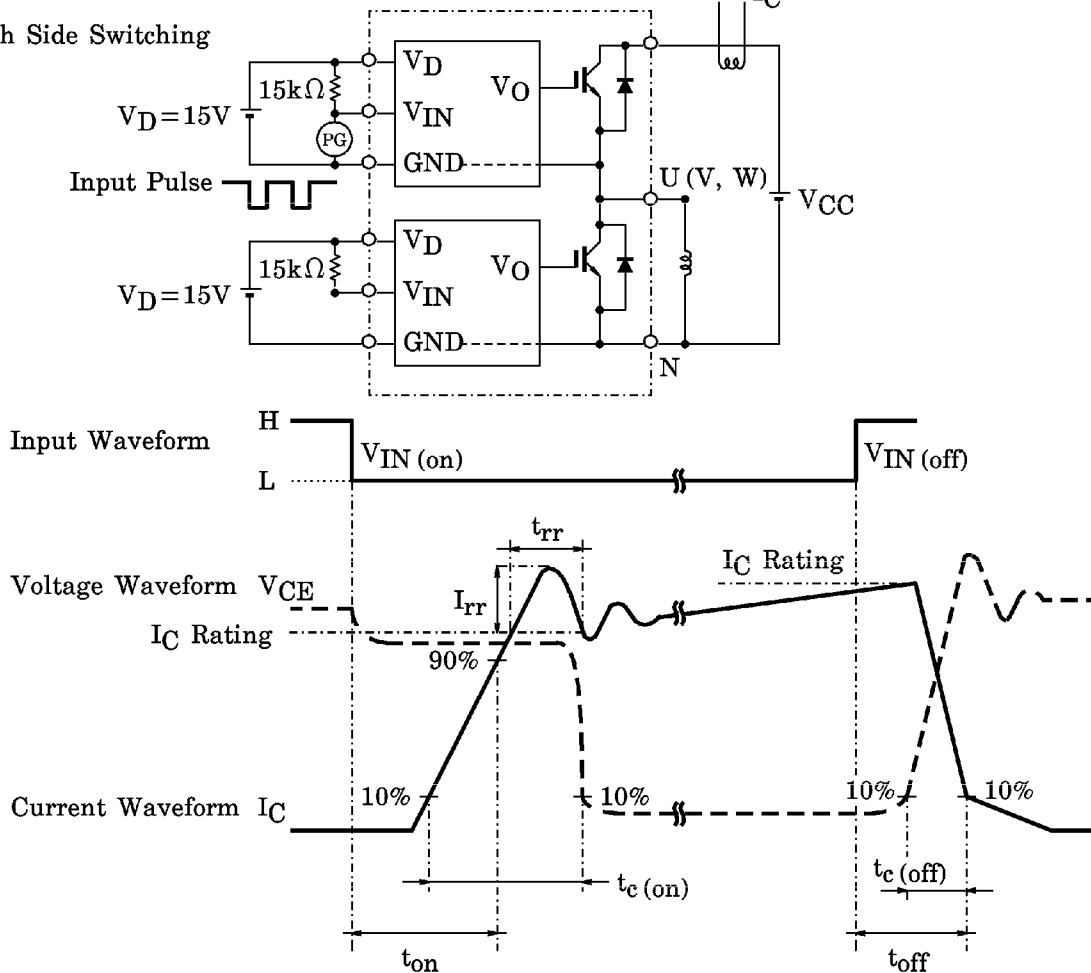
SYMBOL	ITEM	TEST CONDITION	SPEC			UNIT
			MIN.	TYP.	MAX.	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_D = 15\text{V}$ $I_{IN} = 0\text{mA}$	$I_C = 30\text{A}$		—	V
			$I_C = 30\text{A}$, $T_j = 125^\circ\text{C}$		—	
V_F	Forward Voltage	$I_F = 30\text{A}$	—	2.0	2.7	V
t_{on}	Switching Time	$V_{CC} = 300\text{V}$ $I_C = 30\text{A}$ $V_D = 15\text{V}$ $I_{IN} = 1\text{mA} \leftrightarrow 0\text{mA}$ Inductive Load	0.5	1.3	2.0	μs
$t_{c(on)}$			—	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	$V_{CE} = 600\text{V}$	$T_j = 25^\circ\text{C}$		—	mA
			$T_j = 125^\circ\text{C}$		—	

Note 1 : Switching Time Test Circuit & Timing Chart

a) Low Side Switching



b) High Side Switching

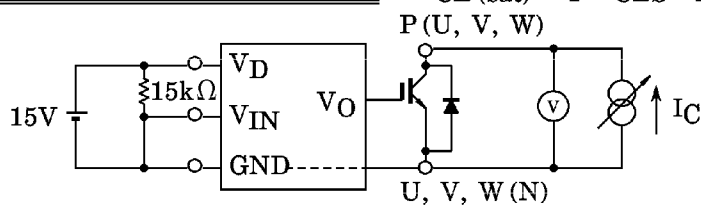
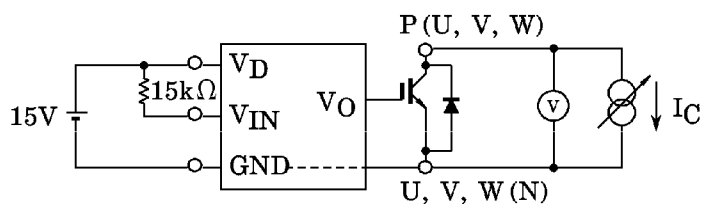
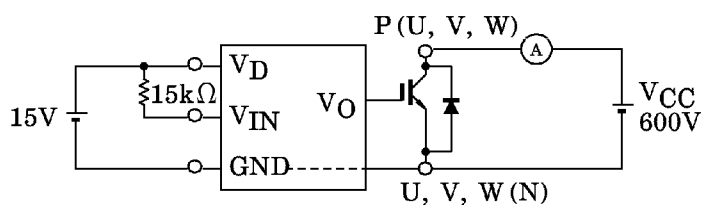
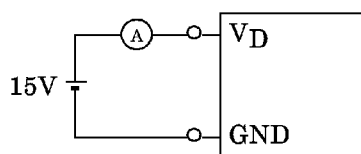
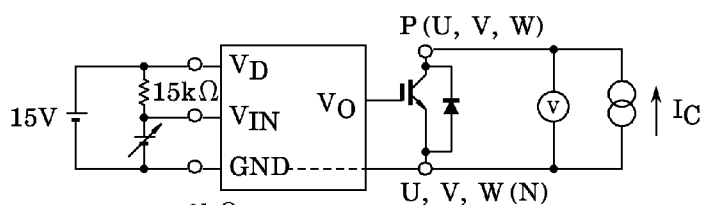
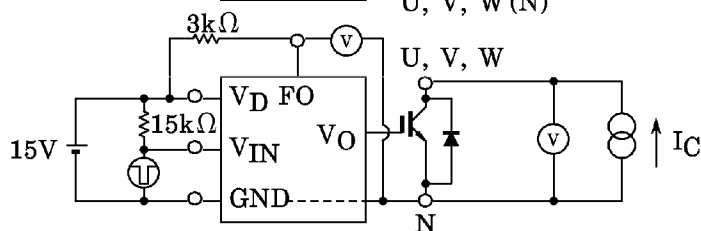
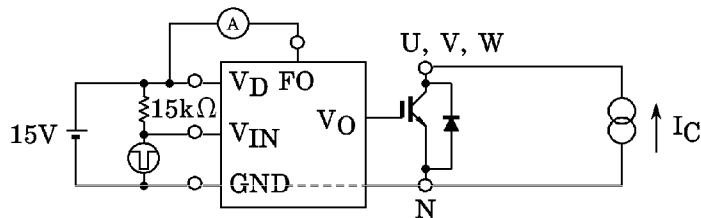


Control Part ($T_j = 25^\circ\text{C}$)

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

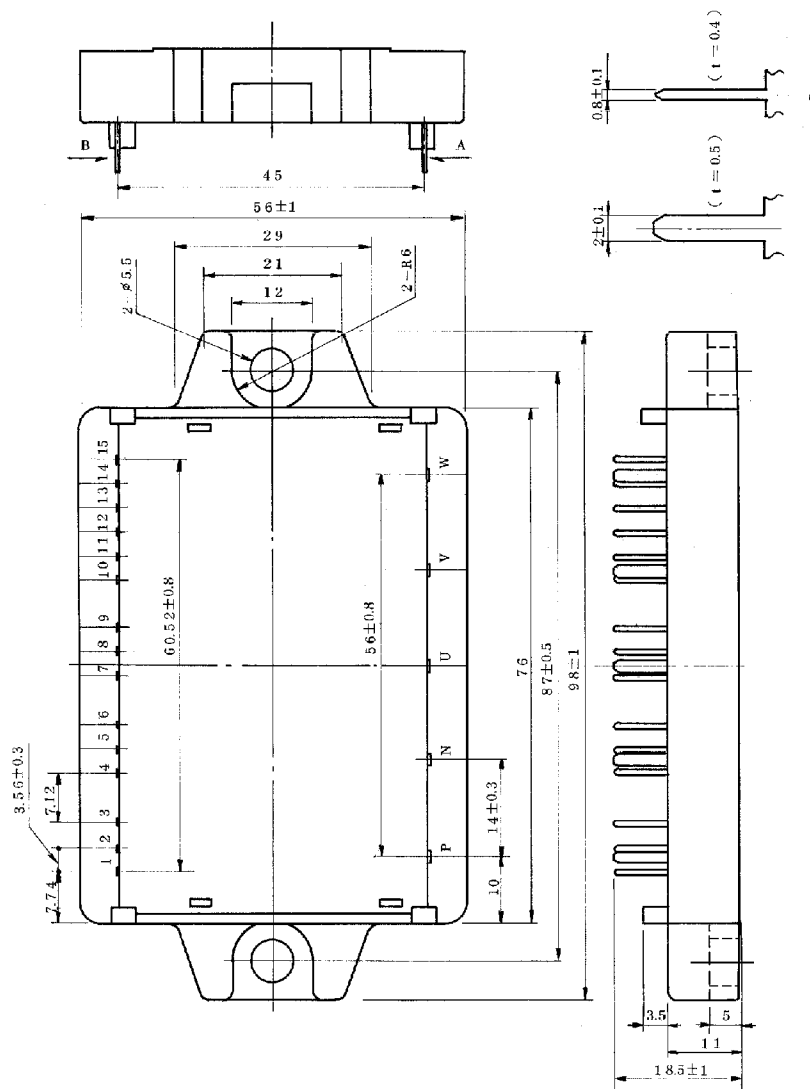
Thermal Resistance ($T_j = 25^\circ\text{C}$)

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

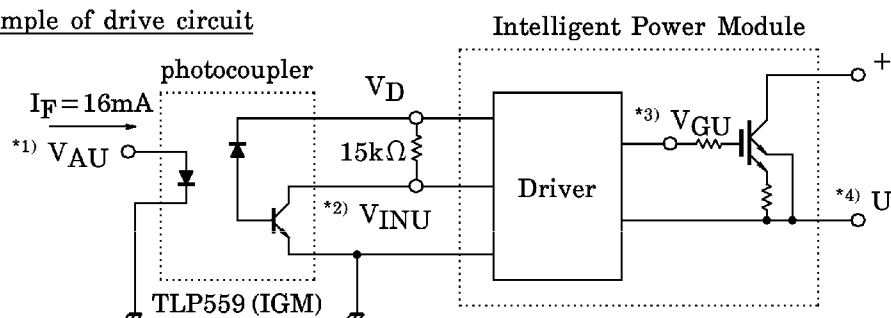
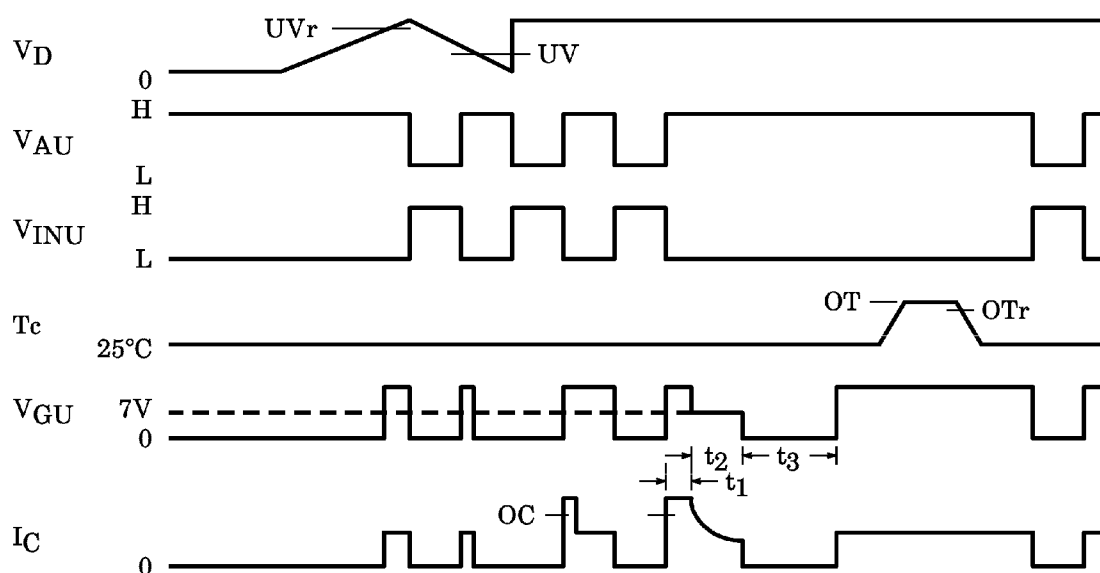
Unit in mm



- | | | |
|----------|----------|----------|
| 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_{AV} , V_{AW} *2) or V_{INV} , V_{INW} *3) or V_{GV} , V_{GW} *4) or V , W 

UV : Under-Voltage Trip Level

UV_r : Under-Voltage Reset Level

OT : Over Temperature Trip Level

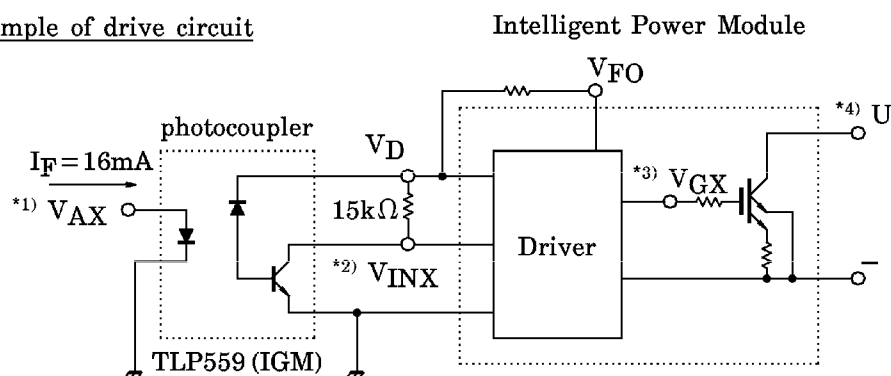
OT_r : Over Temperature Reset Level

OC : Over Current

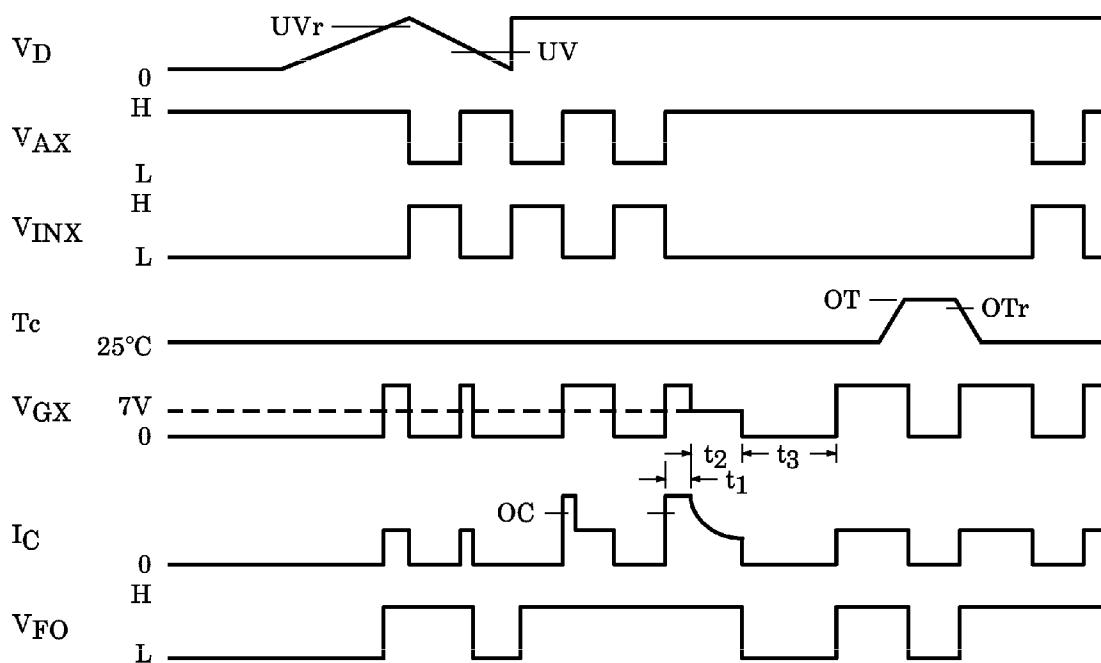
 t_1 : $2.5\mu\text{s}$ (Typ.) t_2 : $10\mu\text{s}$ (Typ.) t_3 : 10ms (Typ.)

TIMING CHART (Low side)

Typical example of drive circuit



- *1) or V_{AY} , V_{AZ}
 *2) or V_{INX} , V_{INZ}
 *3) or V_{GY} , V_{GZ}
 *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.)

