

TOSHIBA INTELLIGENT POWER MODULE SILICON N CHANNEL IGBT

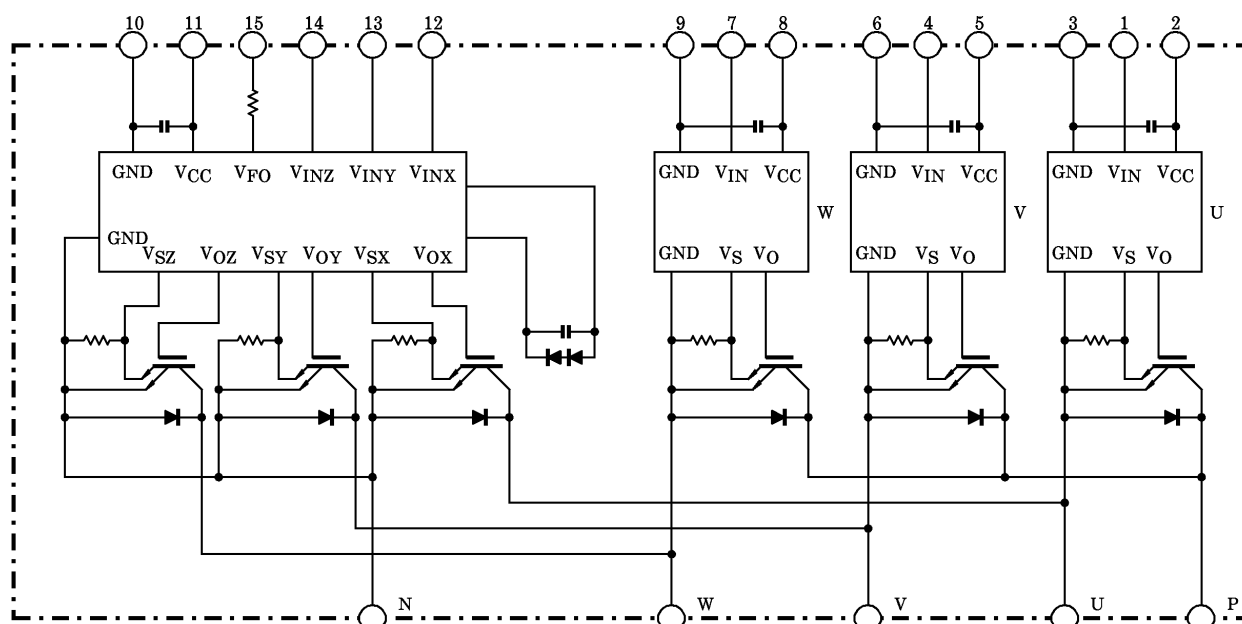
MIG20J103H

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.)
 $t_{rr}=0.2\mu s$ (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)	$T_c = 25^\circ\text{C}$	20	A
	P_C	Collector Power Dissipation	$T_c = 25^\circ\text{C}$	62	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}	Fault Output Voltage	$V_{FO} = V_D$	20	V
	I_{FO}	Fault 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

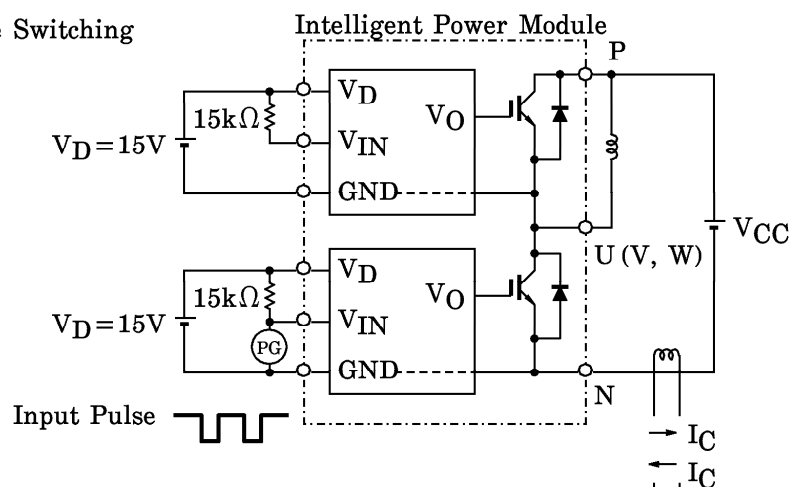
ELECTRICAL CHARACTERISTICS ($T_j = 25^\circ\text{C}$)

Inverter Part

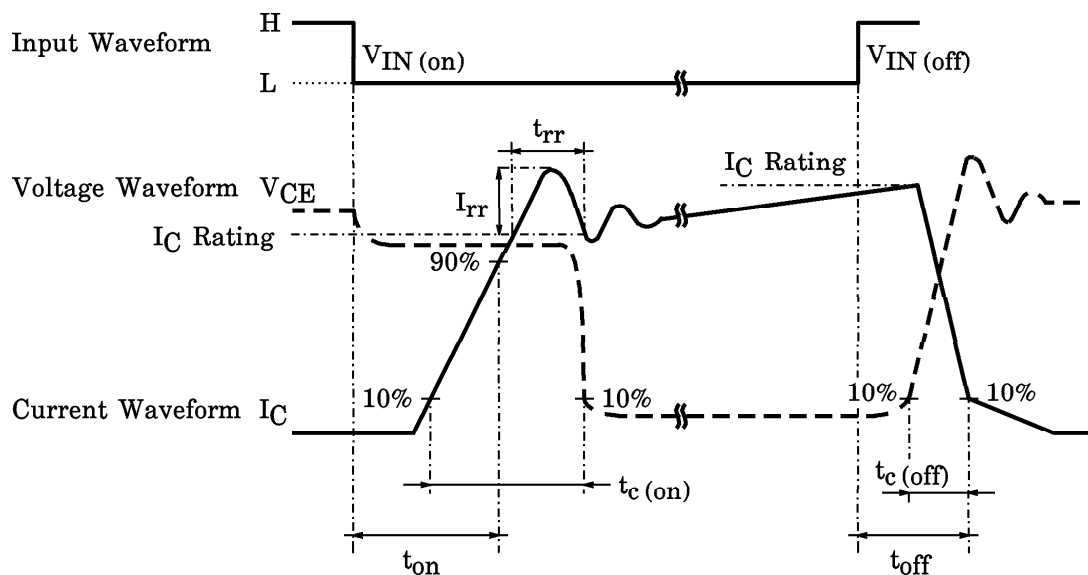
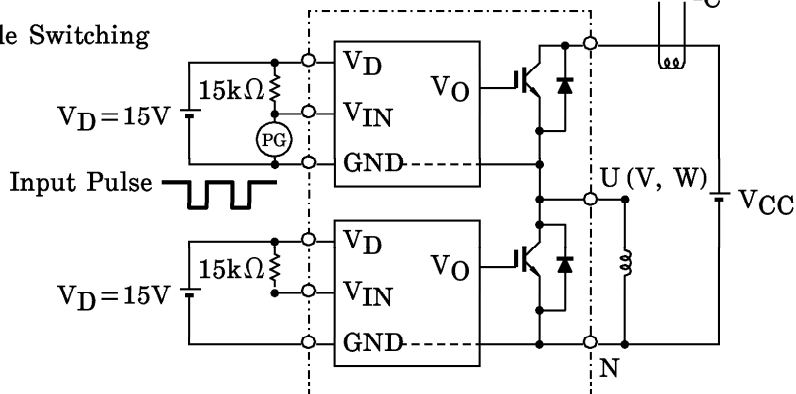
SYMBOL	ITEM	TEST CONDITION	SPEC			UNIT
			MIN.	TYP.	MAX.	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_D = 15\text{V}$ $I_{IN} = 0\text{mA}$	—	2.1	2.7	V
		$I_C = 20\text{A}$ $T_j = 125^\circ\text{C}$	—	—	3.0	
V_F	Forward Voltage	$I_F = 20\text{A}$	—	1.8	2.5	V
t_{on}	Switching Time	$V_{CC} = 300\text{V}$ $I_C = 20\text{A}$ $V_D = 15\text{V}$ $I_{IN} = 1\text{mA} \leftrightarrow 0\text{mA}$ Inductive Load	0.5	1.3	2.0	μs
$t_{c(on)}$			—	0.3	1.0	
t_{off}			0.5	1.0	2.0	
$t_{c(off)}$			—	0.4	1.5	
t_{rr}			—	0.12	0.2	
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

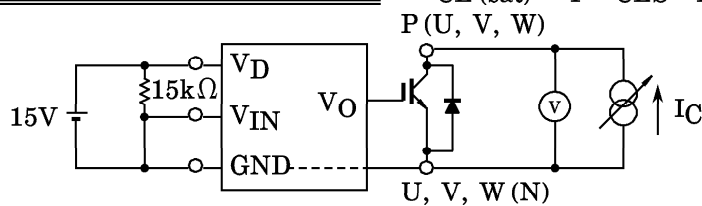
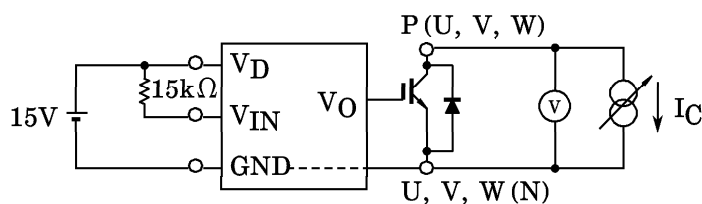
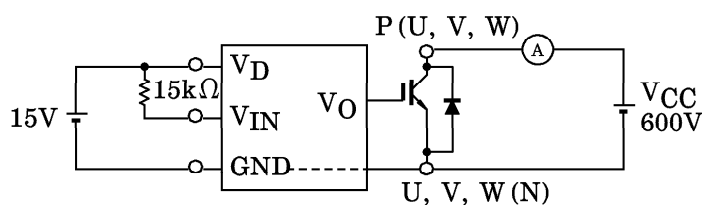
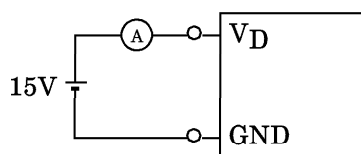
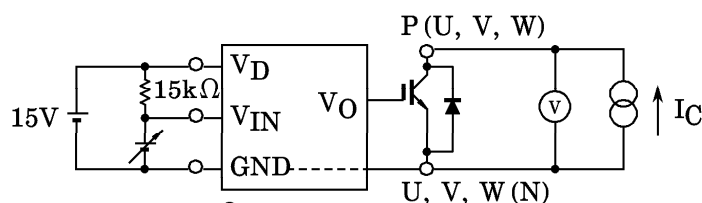
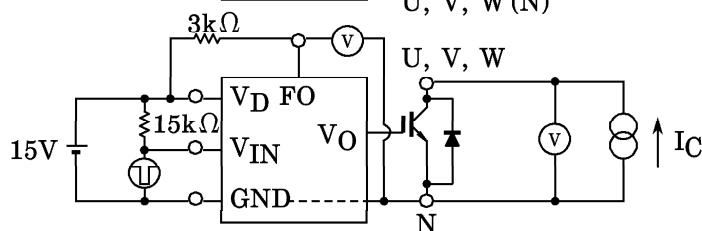
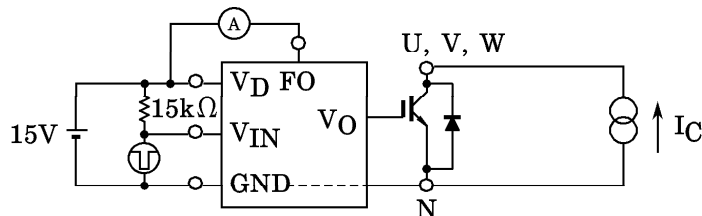


Control Part ($T_j = 25^\circ\text{C}$)

SYMBOL	ITEM		TEST CONDITION		SPEC			UNIT
					MIN.	TYP.	MAX.	
I _D	Circuit Current		V _D =15V	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 =15V, V _{FO} =15V		3	5	7	mA
	Foul Output Current (Normal)				—	—	1	
OC	Over Current Protection Trip Level		V _D =15V		40	43	—	A
			V _D =15V, T _j ≤125°C		32	—	—	
t _{off(OC)}	Over Current Cut Off Time		V _D =15V		5	10	18	μs
OT	Over Temperature Protection	Trip Level	Case Temperature		100	110	120	°C
		Reset Level			80	90	100	
UV	Control Supply Under-Voltage Protection	Trip Level	—		11.3	12.0	12.7	V
UV _r		Reset Level			11.8	12.5	13.2	
t _{FO}	Foul Output Pulse Width		V _D =15V		5	10	15	ms

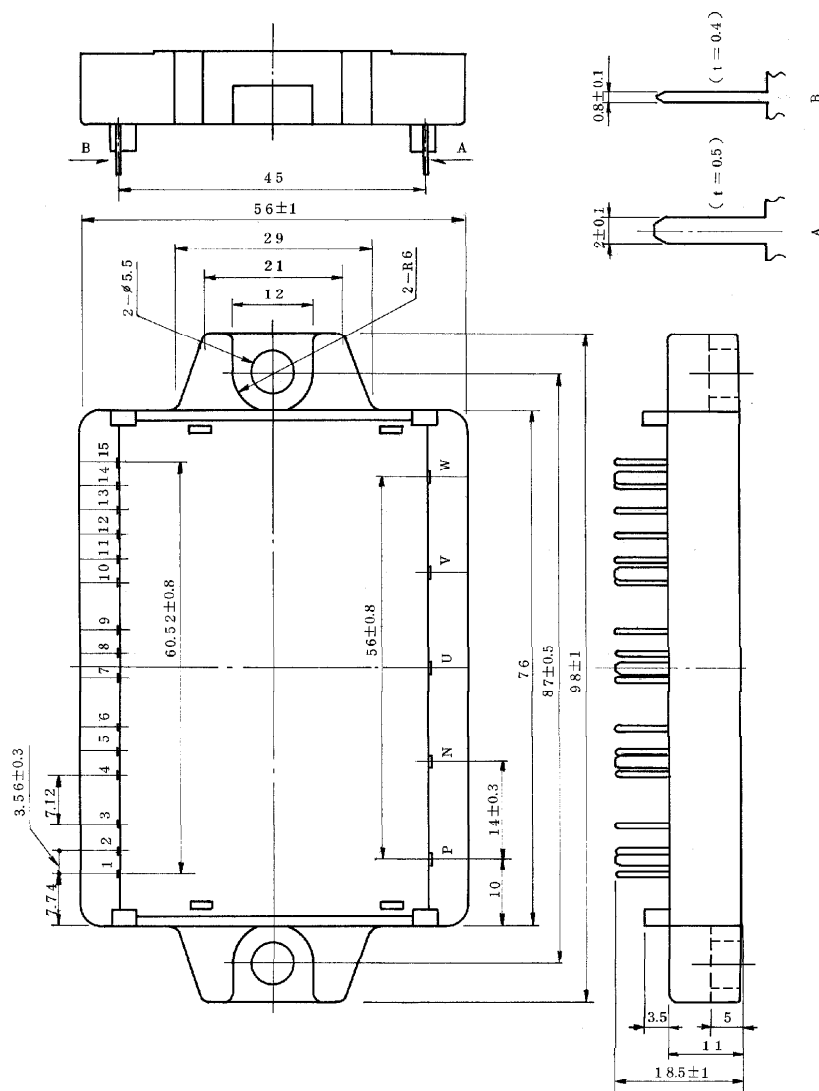
Thermal Resistance ($T_j = 25^\circ\text{C}$)

SYMBOL	ITEM	TEST CONDITION	SPEC			UNIT
			MIN.	TYP.	MAX.	
$R_{th(j-c)}$	Junction to Case Thermal Resistance	INV. IGBT	—	—	2.0	$^\circ\text{C/W}$
$R_{th(j-c)}$		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

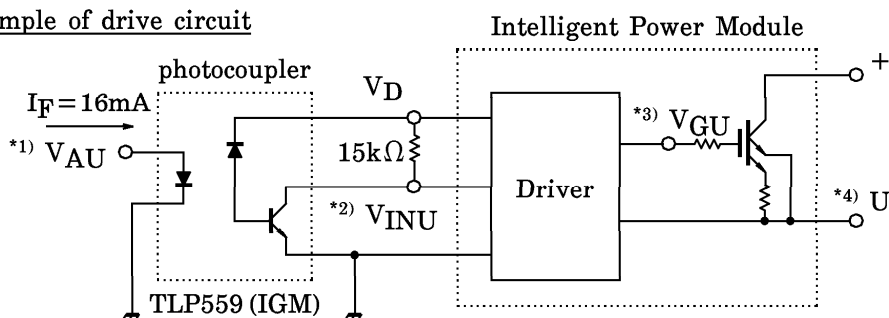
Unit in mm



- | | | |
|----------|----------|----------|
| 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

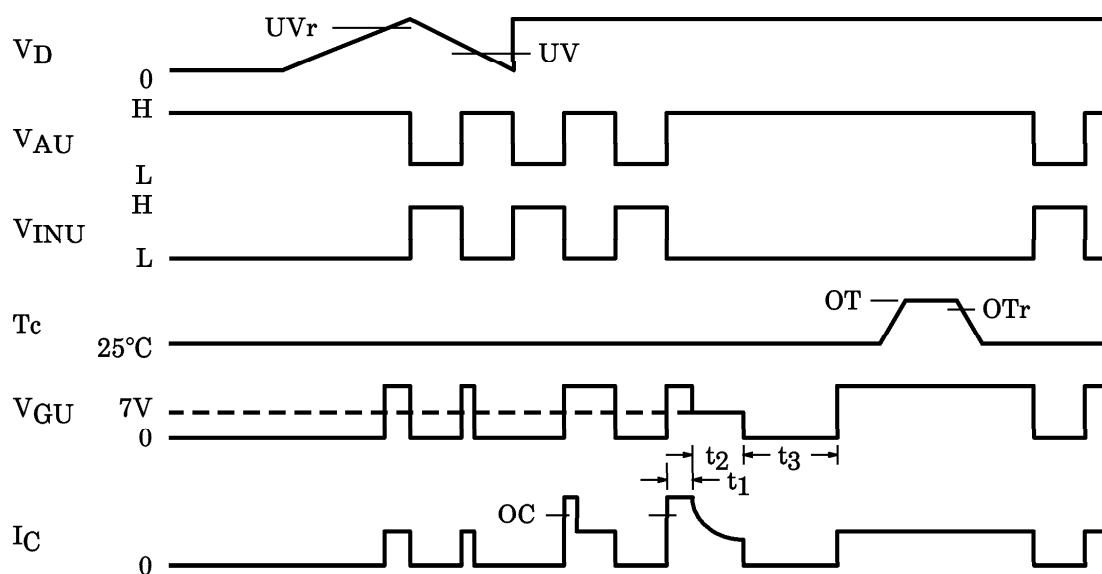


*1) or V_{AV} , V_{AW}

*2) or V_{INV} , V_{INW}

*3) or V_{GV} , V_{GW}

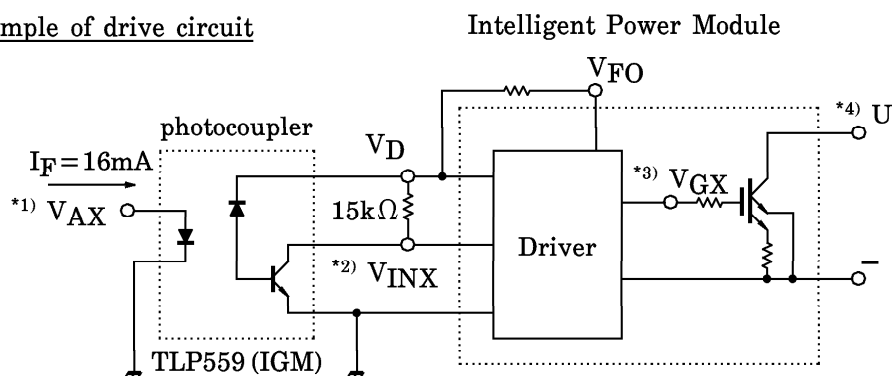
*4) or V , W



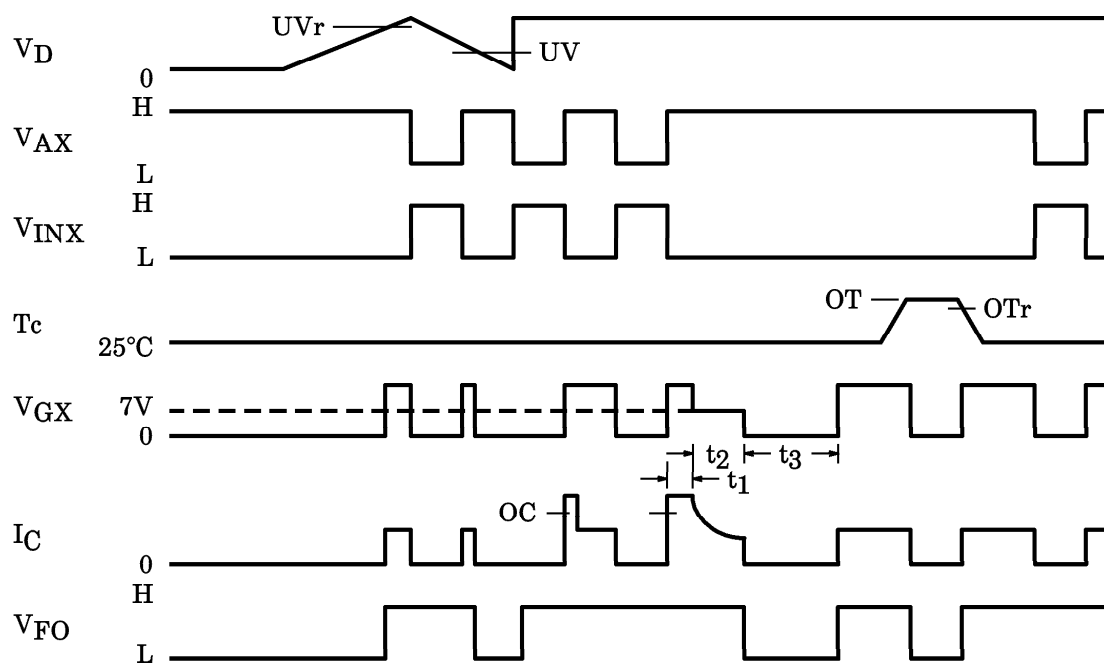
UV : Under-Voltage Trip Level
 UVr : Under-Voltage Reset Level
 OT : Over Temperature Trip Level
 OTr : Over Temperature Reset Level
 OC : Over Current

t_1 : 2.5 μ s (Typ.)
 t_2 : 10 μ 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.)

