TOSHIBA INTELLIGENT POWER MODULE SILICON N CHANNEL IGBT

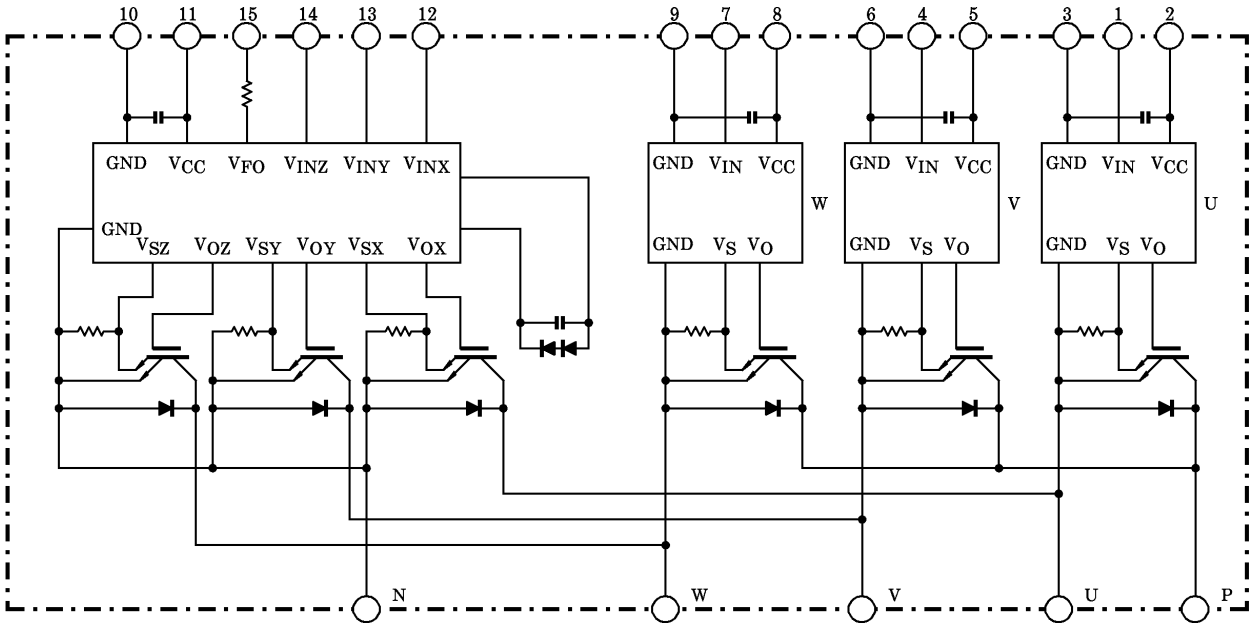
MIG20J103H

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} = 2.0μs (MAX.)
  t_{rr} = 0.2μs (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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- The information contained herein is subject to change without notice.

MAXIMUM RATINGS (T_j = 25°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)	Tc = 25°C	20	A
	P_C	Collector Power Dissipation	Tc = 25°C	62	W
	T_j	Junction Temperature	—	150	°C
Control Part	V_D	Supply Voltage	—	20	V
	V_{IN}	Intput Voltage	$V_{IN} = V_D$	20	V
	V_{FO}	Foul Output Voltage	$V_{FO} = V_D$	20	V
	I_{FO}	Foul Output Current	—	7	mA
All System	Tc	Operating Temperature	—	−20~+100	°C
	T_{stg}	Storage Temperature Range	—	−40~+125	°C
	V_{ISO}	Isolation Voltage	AC, 1 min	2500	V_{rms}
	—	Screw Torque	M5	2	N·m

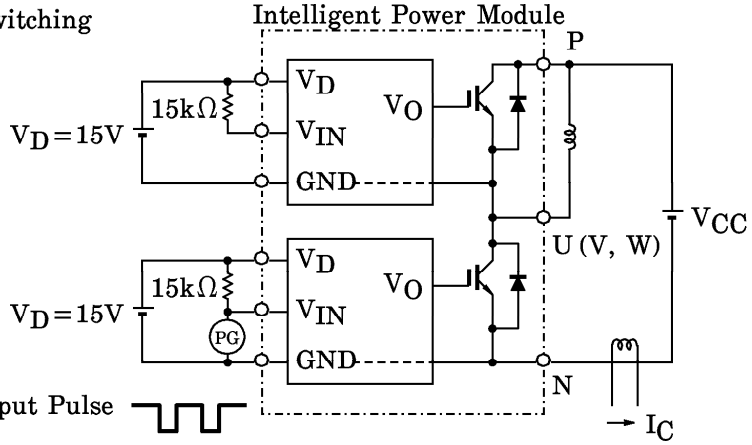
ELECTRICAL CHARACTERISTICS (T_j = 25°C)

Inverter Part

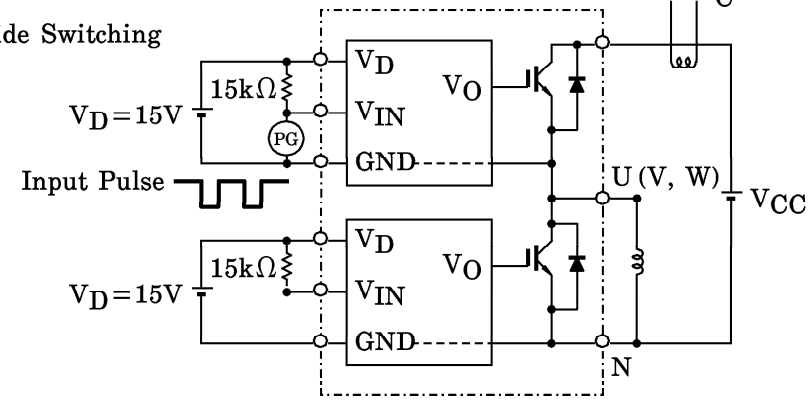
SYMBOL	ITEM	TEST CONDITION		SPEC MIN.	SPEC TYP.	SPEC MAX.	UNIT
$V_{CE\ (sat)}$	Collector-Emitter Saturation Voltage	V_D = 15V, I_{IN} = 0mA	I_C = 20A	—	2.1	2.7	V
			I_C = 20A, T_j = 125°C	—	—	3.0	
V_F	Forward Voltage	I_F = 20A		—	1.8	2.5	V
t_{on}	Switching Time	V_{CC} = 300V, I_C = 20A, V_D = 15V, I_{IN} = 1mA↔0mA, 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} = 600V	T_j = 25°C	—	—	1	mA
			T_j = 125°C	—	—	20	

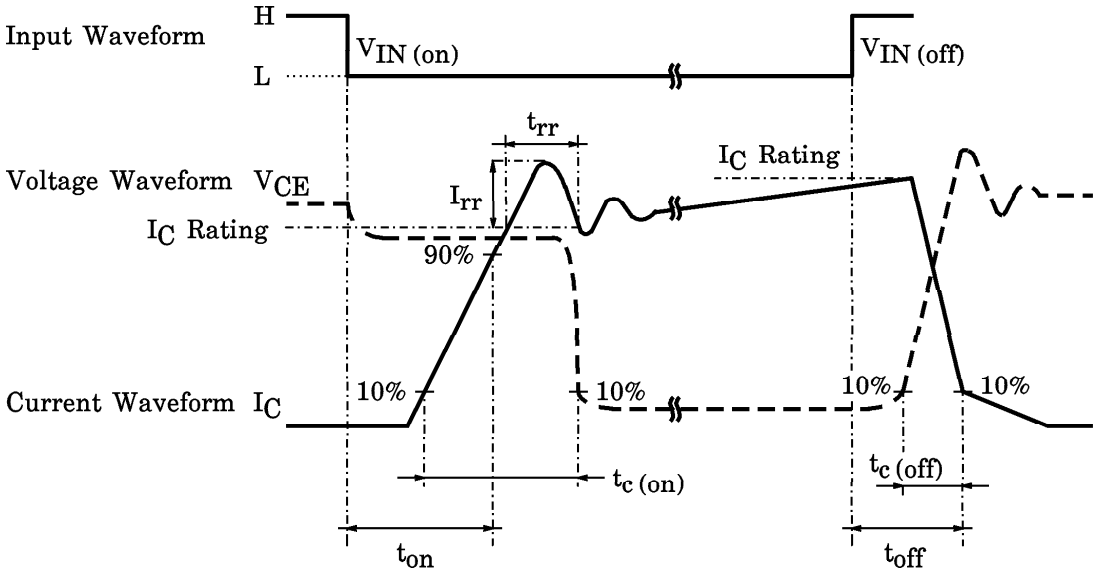
Note 1 : Switching Time Test Circuit & Timing Chart

a) Low Side Switching



b) High Side Switching





Control Part (Tj = 25°C)

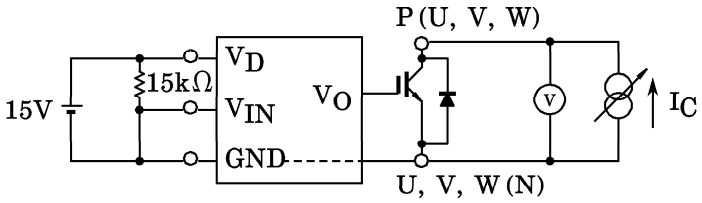
SYMBOL	ITEM		TEST CONDITION		SPEC MIN.	SPEC TYP.	SPEC MAX.	UNIT
I_D	Circuit Current		V_D=15V	High Side	6	12	18	mA
				Low Side	11	23	35	
$V_{IN\ (on)}$	Input On Signal Voltage		—		1.0	1.3	1.6	V
$V_{IN\ (off)}$	Input Off Signal Voltage				1.5	1.8	2.1	
I_{FO}	Foul Output Current (Protection)		V_D=15V, 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, $T_j \leqq 125°C$		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
UVr		Reset Level			11.8	12.5	13.2	
t_{FO}	Foul Output Pulse Width		V_D=15V		5	10	15	ms

Thermal Resistance (Tj = 25°C)

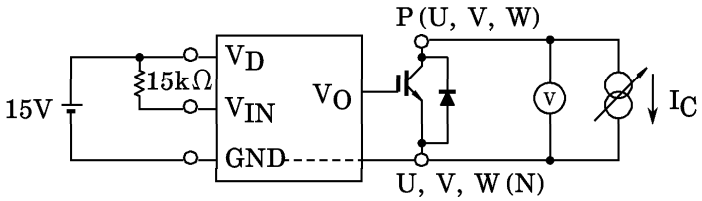
SYMBOL	ITEM	TEST CONDITION	SPEC MIN.	SPEC TYP.	SPEC MAX.	UNIT
$R_{th\ (j-c)}$	Junction to Case Thermal Resistance	INV. IGBT	—	—	2.0	°C / W
$R_{th\ (j-c)}$		INV. FWD	—	—	4.5	
$R_{th\ (c-f)}$	Case to Fin Thermal Resistance with compound	—	—	0.2	—	

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

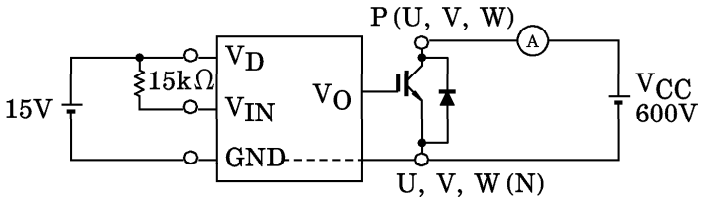
a) $V_{CE\,(sat)}$



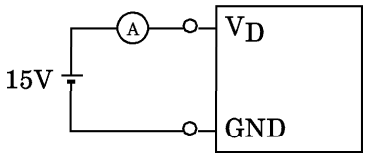
b) V_F



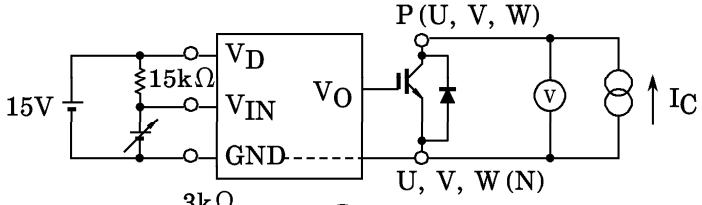
c) I_{CES}



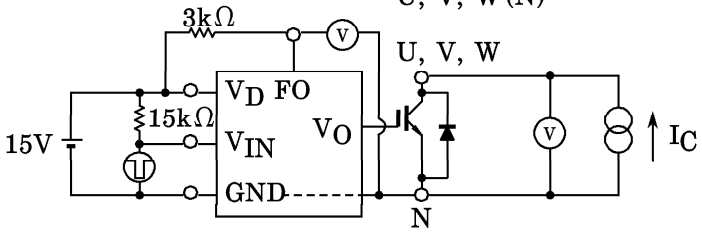
d) I_D



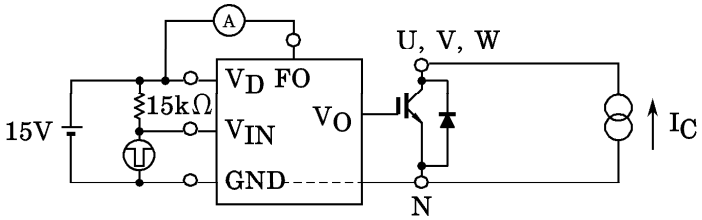
e) $V_{IN(OFF)}$
$V_{IN(ON)}$



f) t_{FO}

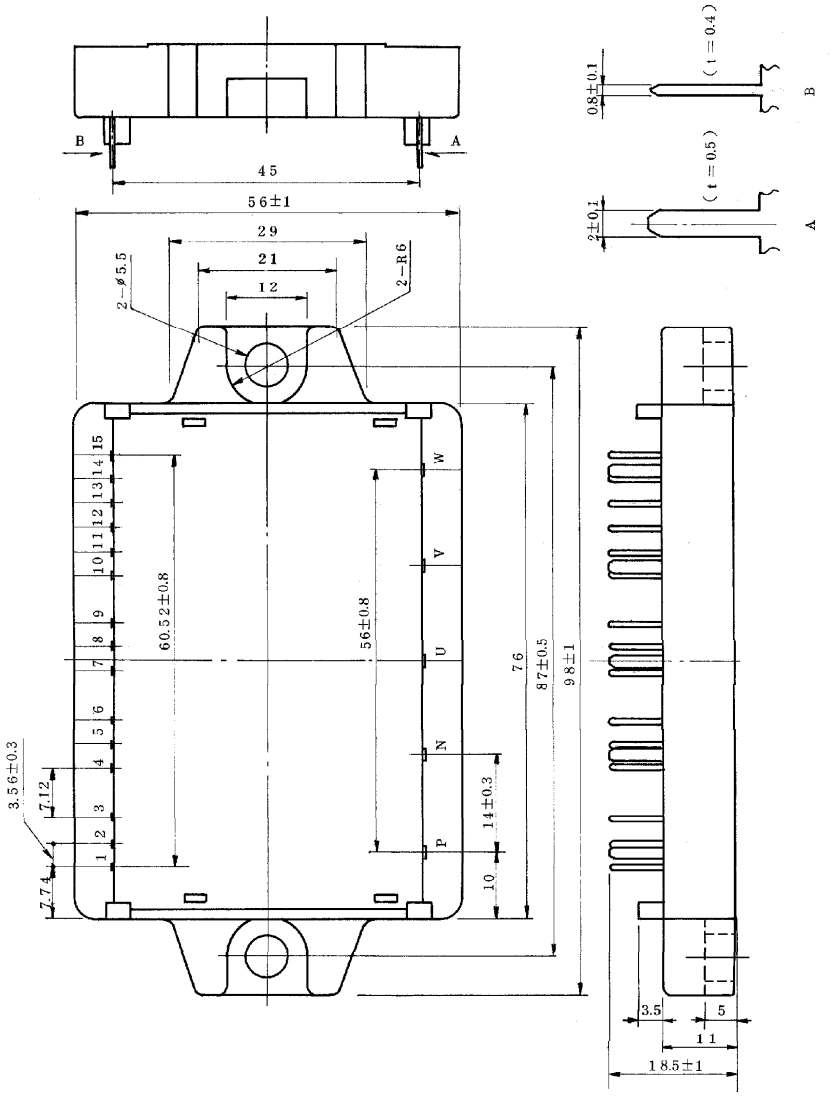


g) I_{FO}



OUTLINE : TOSHIBA 2-99E1A

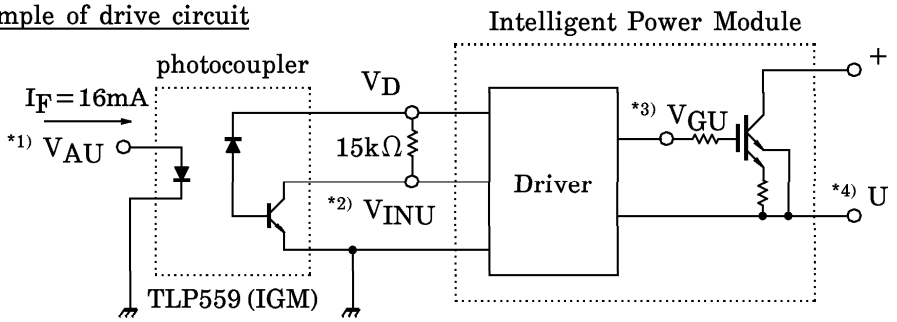
Unit in mm



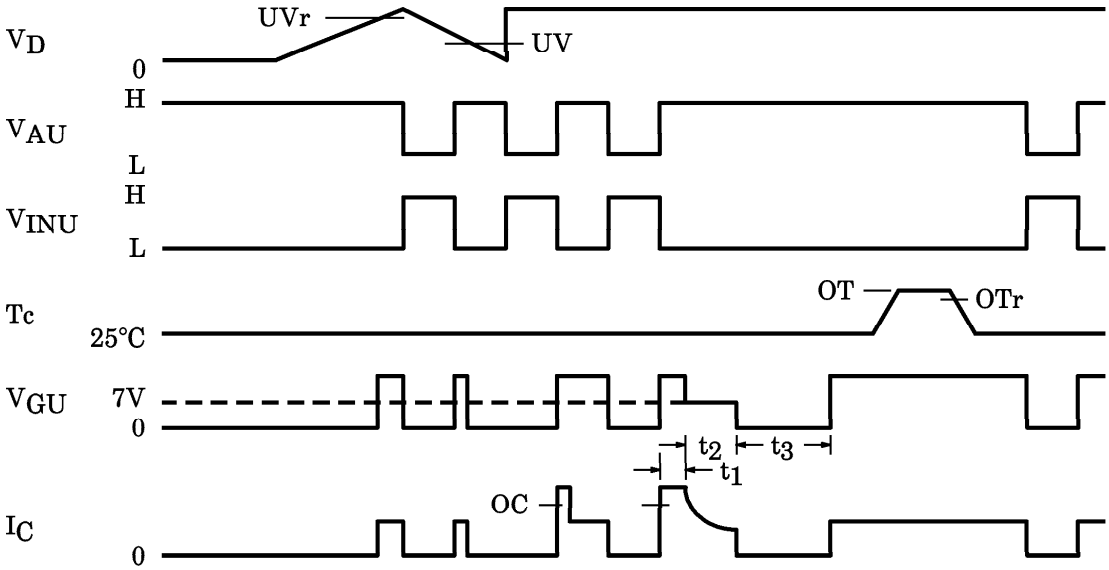
1. V_{INU}	2. V_{DU}	3. GND_U
4. V_{INV}	5. V_{DV}	6. GND_V
7. V_{INW}	8. V_{DW}	9. GND_W
10. GND_L	11 V_{DL}	12. V_{INX}
13. V_{INY}	14. V_{INZ}	15. V_{FO}

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

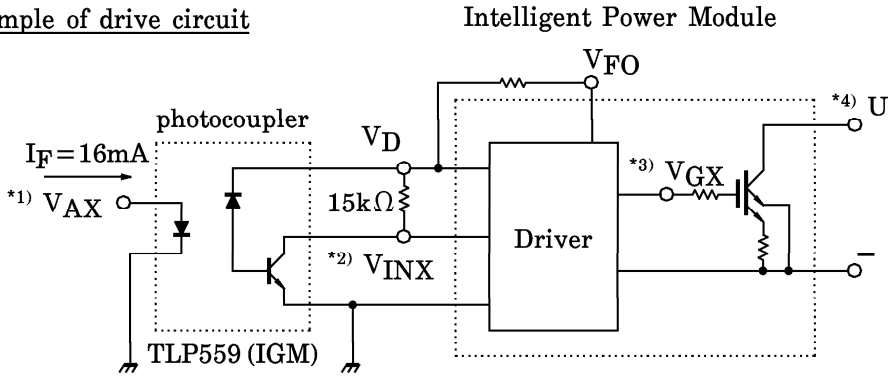


UV : Under-Voltage Trip Level
UVr : Under-Voltage Reset Level
OT : Over Temperature Trip Level
OTr : Over Temperature Reset Level
OC : Over Current

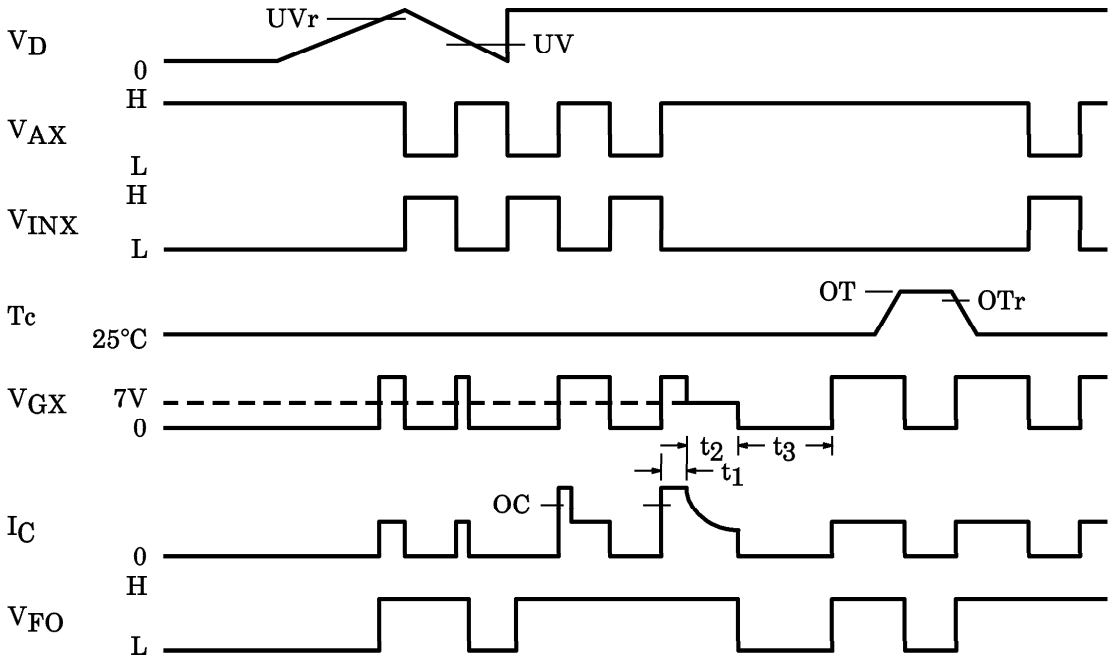
t_1 : 2.5μs (Typ.)
t_2 : 10μs (Typ.)
t_3 : 10ms (Typ.)

TIMING CHART (Low side)

Typical example of drive circuit



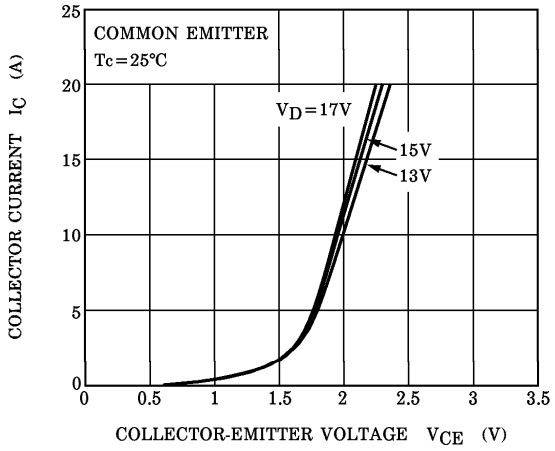
*1) or V_{AY}, V_{AZ}
*2) or V_{INY}, V_{INZ}
*3) or V_{GY}, V_{GZ}
*4) or V, W



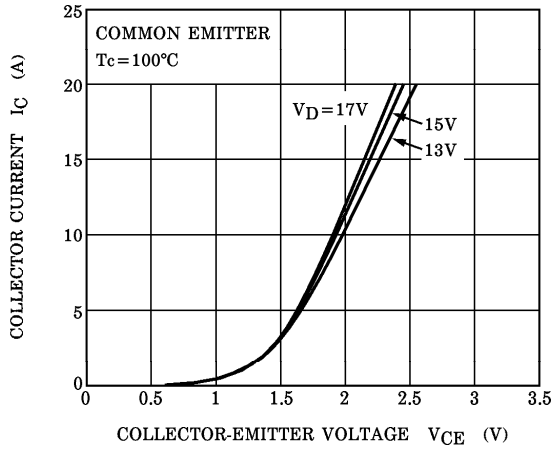
UV : Under-Voltage Trip Level
UVr : Under-Voltage Reset Level
OT : Over Temperature Trip Level
OTr : Over Temperature Reset Level
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t_1 : 2.5μs (Typ.)
t_2 : 10μs (Typ.)
t_3 : 10ms (Typ.)

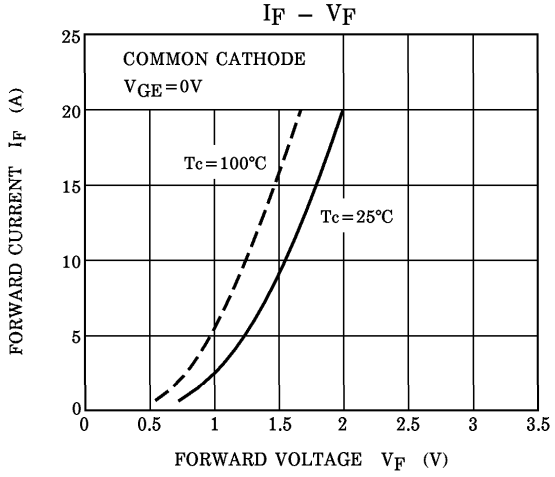
I_C – V_{CE}



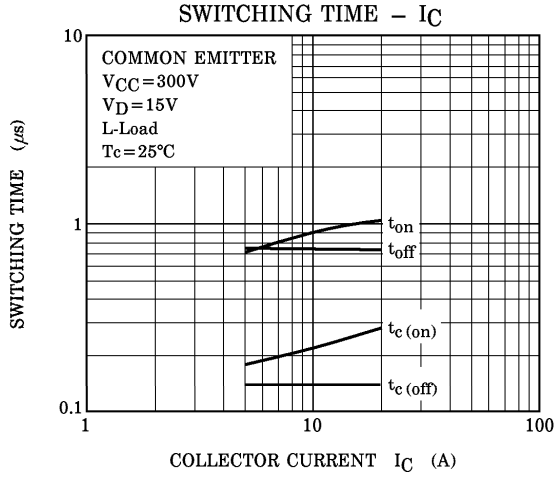
I_C – V_{CE}



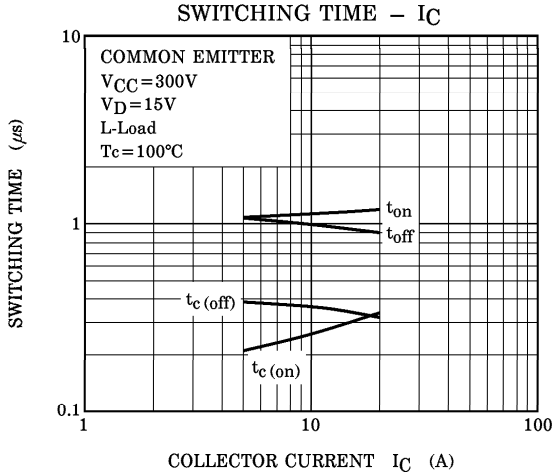
I_F – V_F



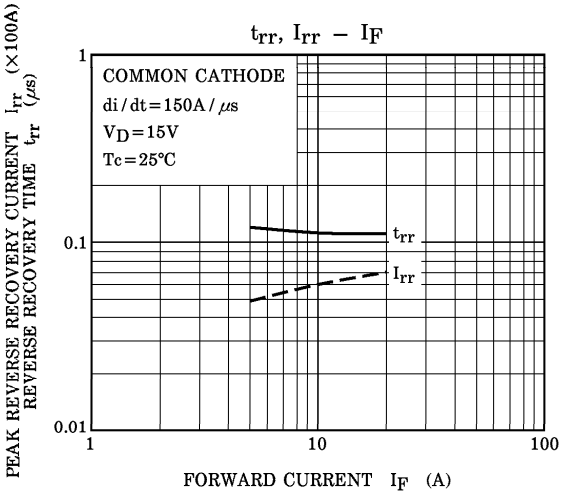
SWITCHING TIME – I_C



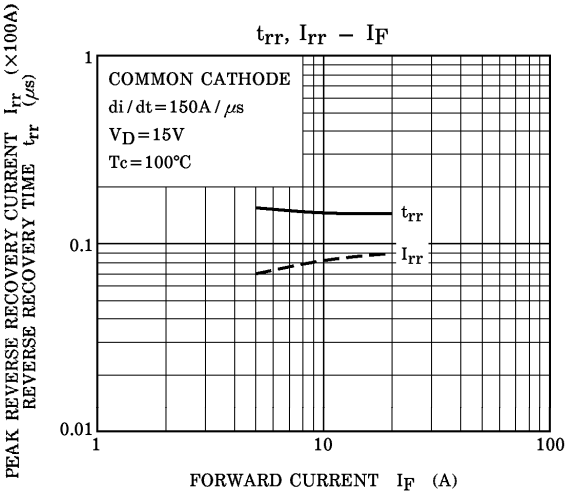
SWITCHING TIME – I_C



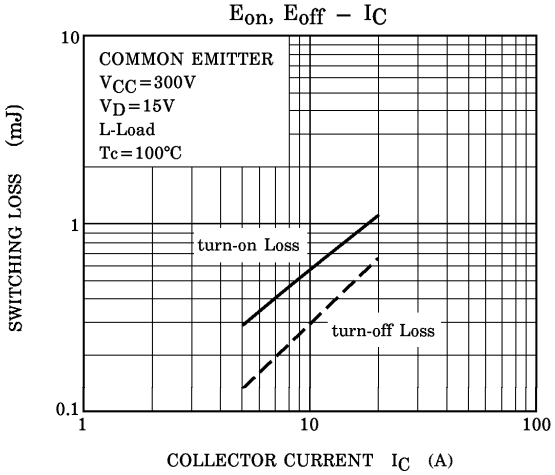
t_{rr}, I_{rr} – I_F



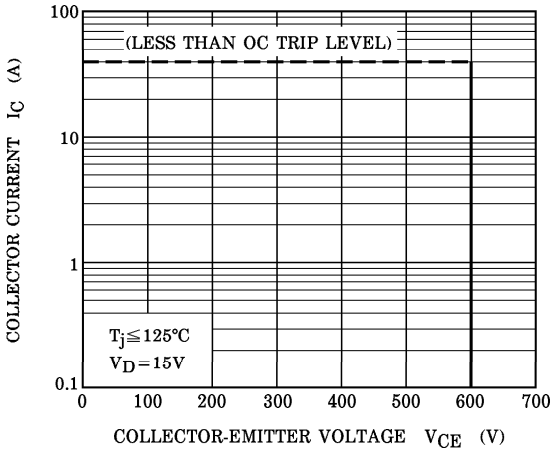
t_{rr}, I_{rr} – I_F



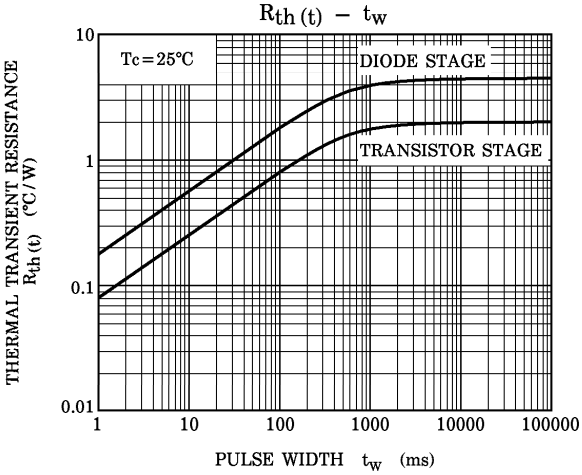
E_{on}, E_{off} – I_C



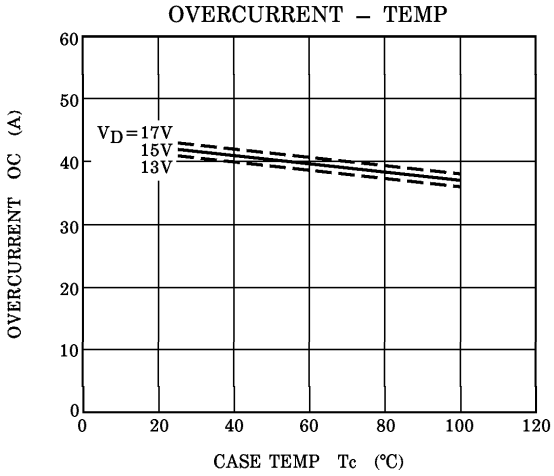
REVERSE BIAS SOA



$R_{th\,(t)}$ – t_w



OVERCURRENT – TEMP



UNDERVOLTAGE – TEMP

