

TOSHIBA Multi-Chip Transistor
Silicon NPN Epitaxial Type, Field Effect Transistor Silicon N Channel MOS Type

TPCP8H02

STROBE FLASH APPLICATIONS
HIGH-SPEED SWITCHING APPLICATIONS
DC-DC CONVERTER APPLICATIONS

- Multi-chip discrete device; built-in NPN transistor for main switch and N-ch MOS FET for drive
- High DC current gain: $h_{FE} = 250$ to 400 ($I_C = 0.3$ A) (NPN transistor)
- Low collector-emitter saturation voltage: $V_{CE(sat)} = 0.14$ V (max) (NPN transistor)
- High-speed switching: $t_f = 25$ ns (typ.) (NPN transistor)

Absolute Maximum Ratings (Ta = 25°C)

Transistor

Characteristics		Symbol	Rating	Unit
Collector-base voltage		V_{CBO}	50	V
Collector-emitter voltage		V_{CEX}	50	V
		V_{CEO}	30	
Emitter-base voltage		V_{EBO}	6	V
Collector current	DC (Note 1)	I_C	3.0	A
	Pulse (Note 1)	I_{CP}	5.0	
Base current		I_B	0.3	A
Collector power dissipation (NPN)		P_C (Note 2)	1.0	W
Junction temperature		T_j	150	°C

MOS FET

Characteristics		Symbol	Rating	Unit
Drain-Source Voltage		V_{DSS}	20	V
Gate-Source Voltage		V_{GSS}	± 10	V
Drain Current	DC	I_D	100	mA
	Pulse	I_{DP}	200	
Channel Temperature		T_{ch}	150	°C

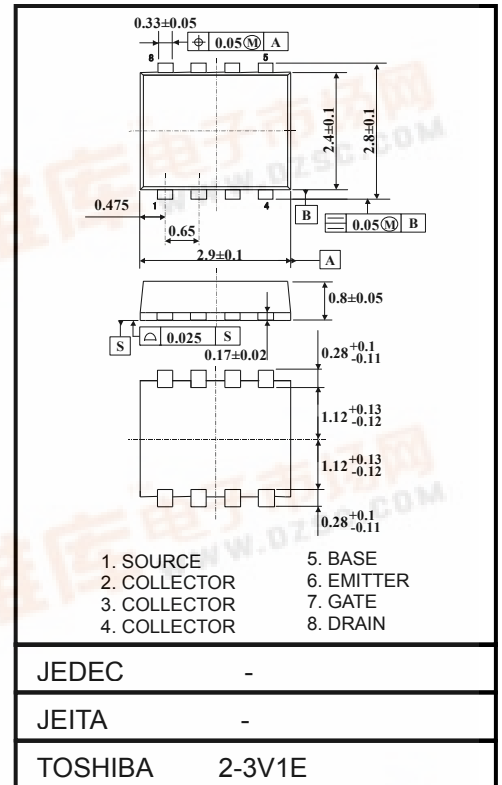
Note 1: Ensure that the junction (channel) temperature does not exceed 150°C.

Note 2: Device mounted on a glass-epoxy board (FR-4, 25.4 × 25.4 × 1.6 mm, Cu area: 645 mm²)

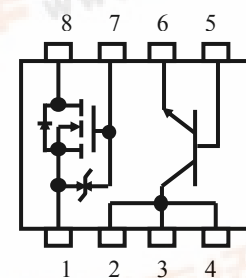
Note 3: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/Derating Concept and Methods) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

This transistor is an electrostatic-sensitive device. Please handle with caution.



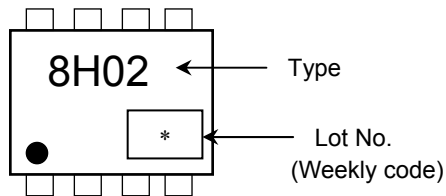
Circuit Configuration



Common Absolute Maximum Rating (Ta = 25°C)

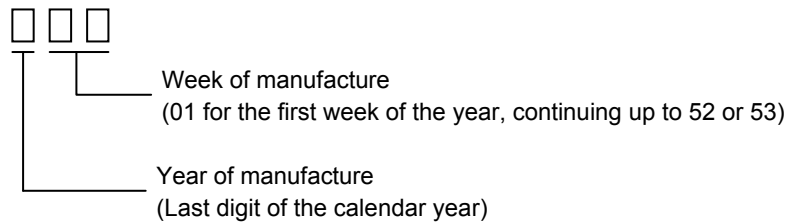
Characteristics	Symbol	Rating	Unit
Storage temperature range	T _{stg}	-55 to 150	°C

Marking (Note 4)



Note 4: The mark "●" on the lower left of the marking indicates Pin 1.

* Weekly code (three digits)

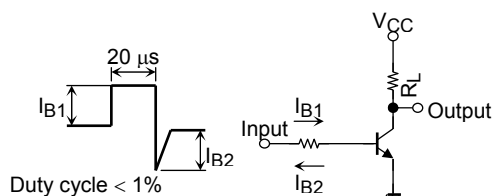


Electrical Characteristics (Ta = 25°C)

Transistor

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit	
Collector cut-off current	I _{CBO}	V _{CB} = 50 V, I _E = 0	—	—	100	nA	
Emitter cut-off current	I _{EBO}	V _{EB} = 6 V, I _C = 0	—	—	100	nA	
Collector-emitter breakdown voltage	V _{(BR) CEO}	I _C = 10 mA, I _B = 0	30	—	—	V	
DC current gain	h _{FE} (1)	V _{CE} = 2 V, I _C = 0.3 A	250	—	400		
	h _{FE} (2)	V _{CE} = 2 V, I _C = 1.0 A	120	—	—		
Collector-emitter saturation voltage	V _{CE (sat)}	I _C = 1.0 A, I _B = 33 mA	—	—	140	mV	
Base-emitter saturation voltage	V _{BE (sat)}	I _C = 1.0 A, I _B = 33 mA	—	—	1.1	V	
Collector output capacitance	C _{ob}	V _{CB} = 10V, I _E = 0, f=1MHz	—	18	—	pF	
Switching time	Rise time	t _r	See Figure 1 circuit diagram. V _{CC} ≐ 12 V, R _L = 12 Ω I _{B1} = -I _{B2} = 33 mA	—	40	—	ns
	Storage time	t _{stg}		—	320	—	
	Fall time	t _f		—	25	—	

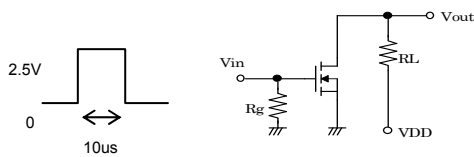
Figure 1 Switching Time Test Circuit & Timing Chart



MOS FET

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	$V_{GS} = \pm 10\text{ V}, V_{DS} = 0$	—	—	± 1	$\mu\text{ A}$
Drain-source breakdown voltage		$V_{(BR)DSS}$	$I_D = 0.1\text{ mA}, V_{GS} = 0$	20	—	—	V
Drain cut-off current		I_{DSS}	$V_{DS} = 20\text{ V}, V_{GS} = 0$	—	—	1	$\mu\text{ A}$
Gate threshold voltage		V_{th}	$V_{DS} = 3\text{ V}, I_D = 0.1\text{ mA}$	0.6	—	1.1	V
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 3\text{ V}, I_D = 10\text{ mA}$	40	—	—	mS
Drain-source ON-resistance		$R_{DS(ON)}$	$I_D = 10\text{ mA}, V_{GS} = 4\text{ V}$	—	1.5	3	Ω
			$I_D = 10\text{ mA}, V_{GS} = 2.5\text{ V}$	—	2.2	4	
			$I_D = 1\text{ mA}, V_{GS} = 1.5\text{ V}$	—	5.2	15	
Input capacitance		C_{iss}	$V_{DS} = 3\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	9.3	—	pF
Reverse transfer capacitance		C_{rss}		—	4.5	—	
Output capacitance		C_{oss}		—	9.8	—	
Switching time	Turn-on time	t_{on}	See Figure 2 circuit diagram.	—	70	—	ns
	Turn-off time	t_{off}	$V_{DD} \doteq 3\text{ V}, R_L = 300\ \Omega$ $V_{GS} = 0\text{ to }2.5\text{ V}$	—	125	—	

Figure 2 Switching Time Test Circuit & Timing Chart



Gate Pulse Width $10\ \mu\text{ s}$, $t_r, t_f < 5\text{ ns}$
 ($Z_{out} = 50\ \Omega$), Common Source, $T_a = 25^\circ\text{ C}$
 Duty Cycle $< 1\%$

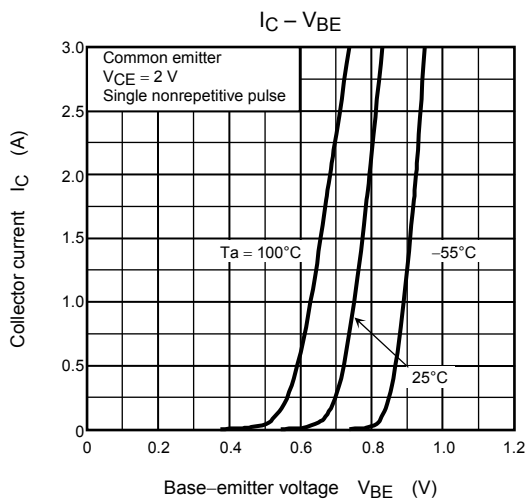
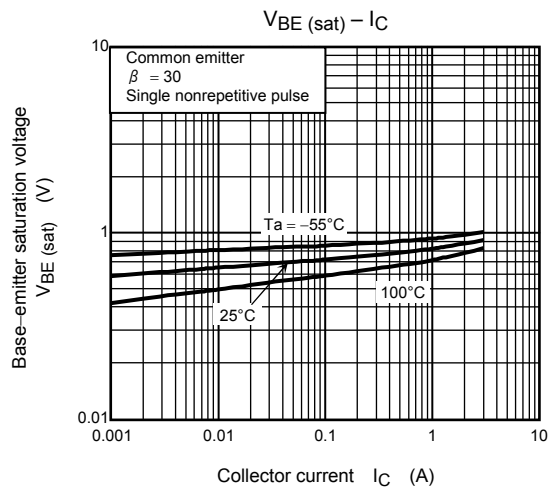
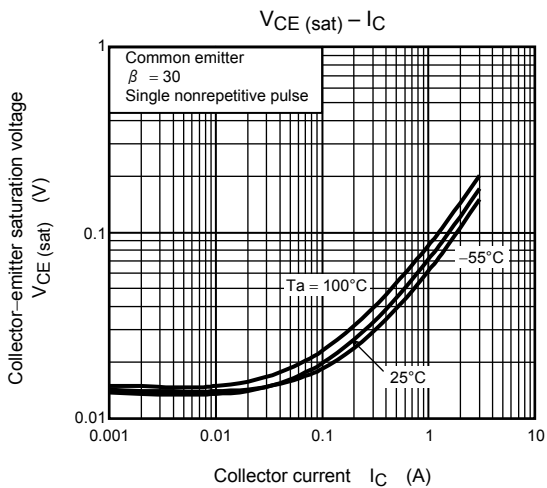
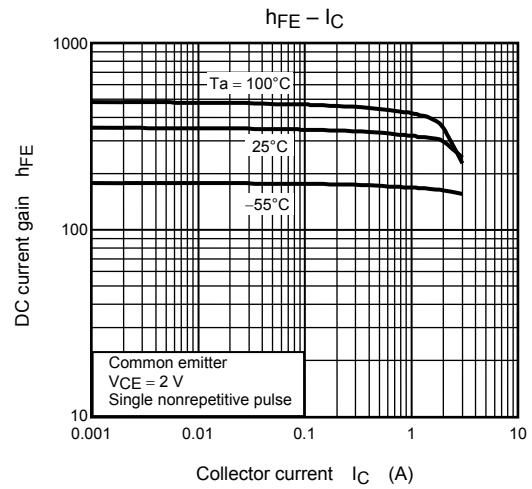
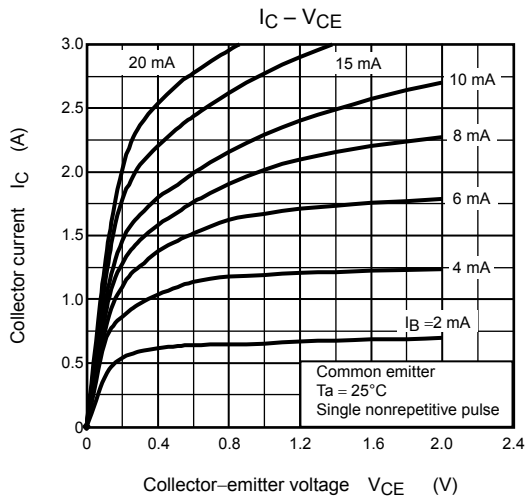
Precautions

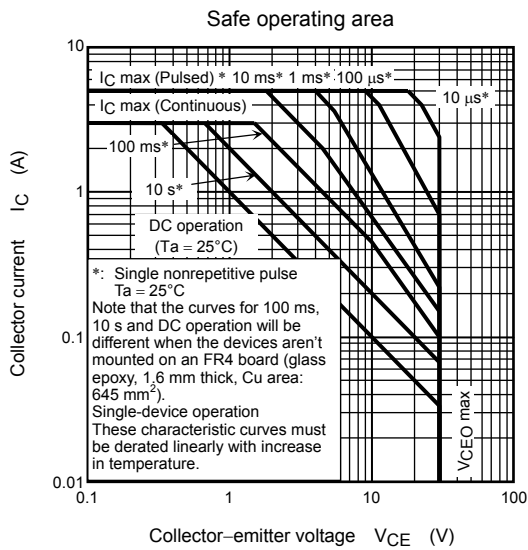
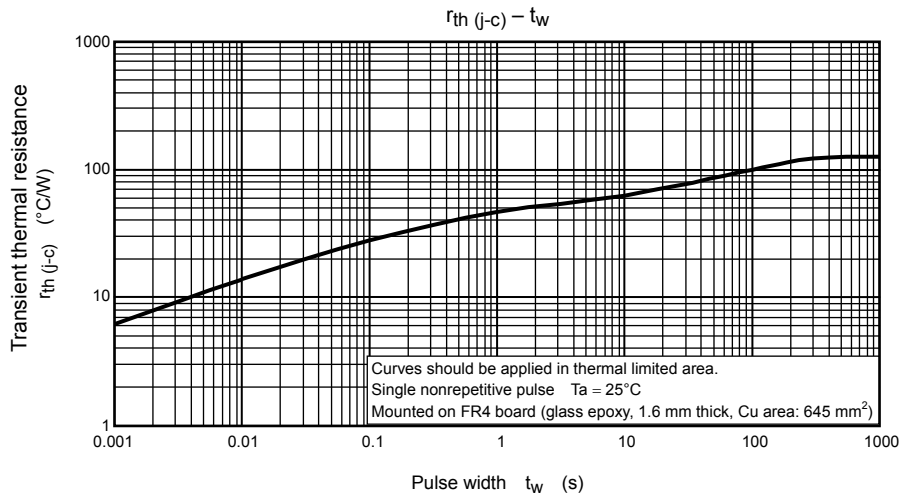
V_{th} can be expressed as the voltage between gate and source when the low operating current value is $I_D = 100\ \mu\text{ A}$ for this product. For normal switching operation, $V_{GS(ON)}$ requires a higher voltage than V_{th} and $V_{GS(OFF)}$ requires a lower voltage than V_{th} .

(The relationship can be established as follows: $V_{GS(OFF)} < V_{th} < V_{GS(ON)}$)

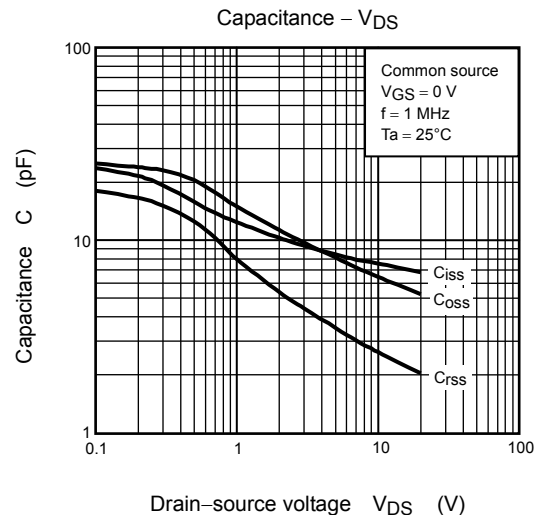
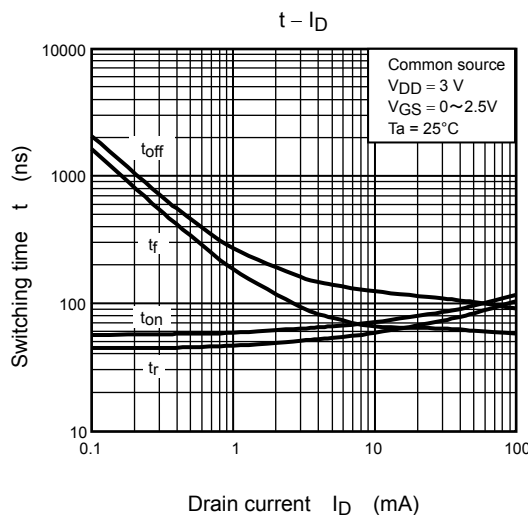
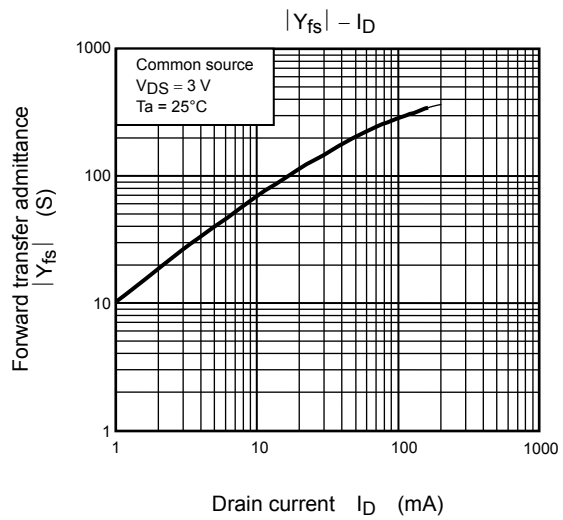
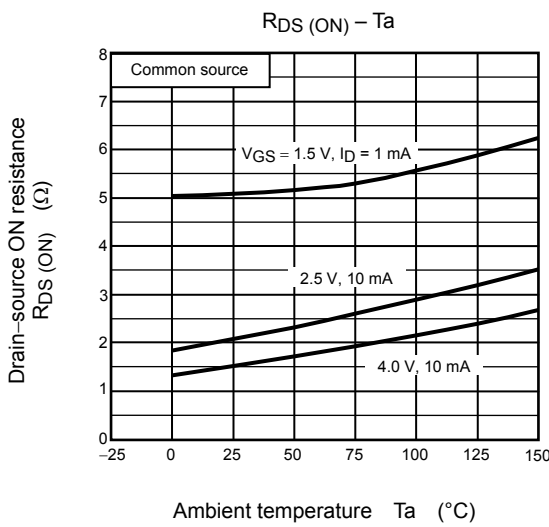
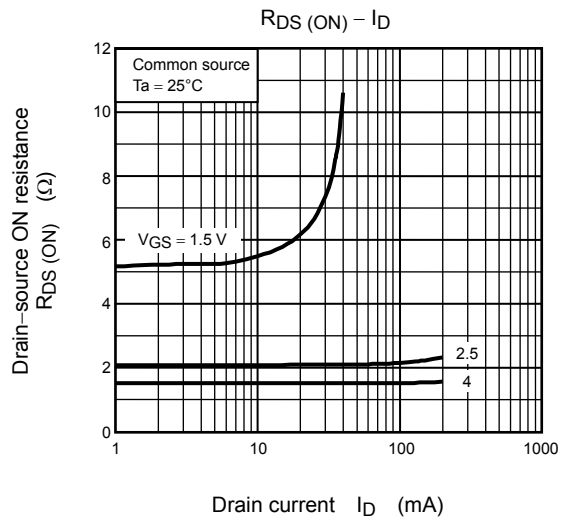
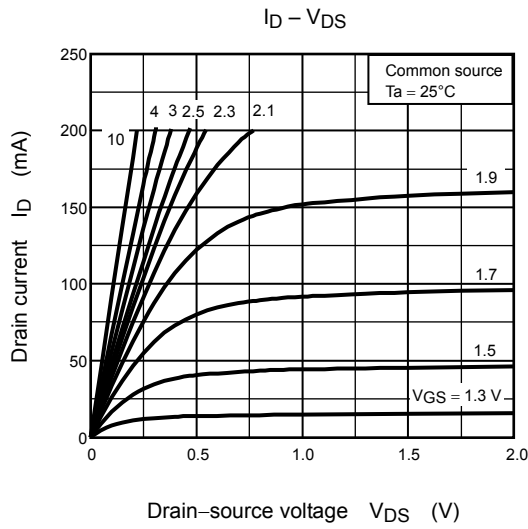
Please take this into consideration when using the device. The V_{GS} recommended voltage for turning on this product is 2.5 V or higher.

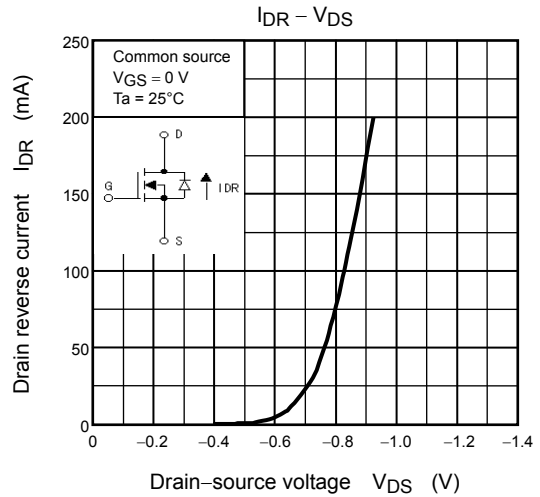
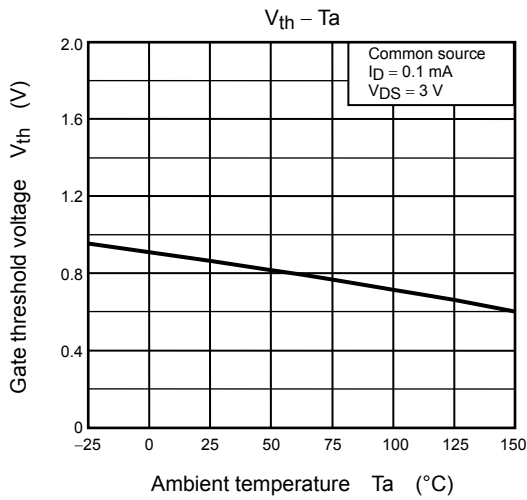
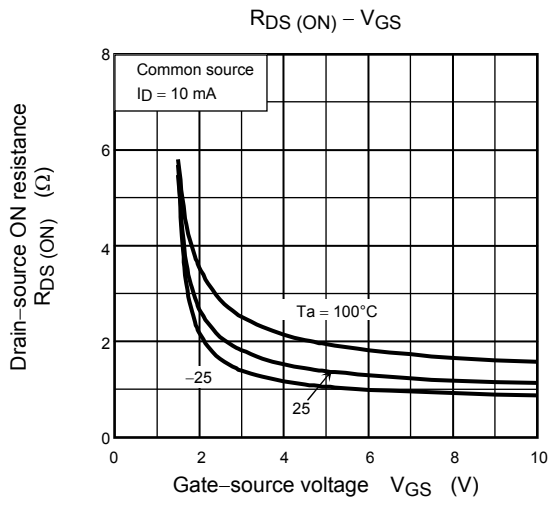
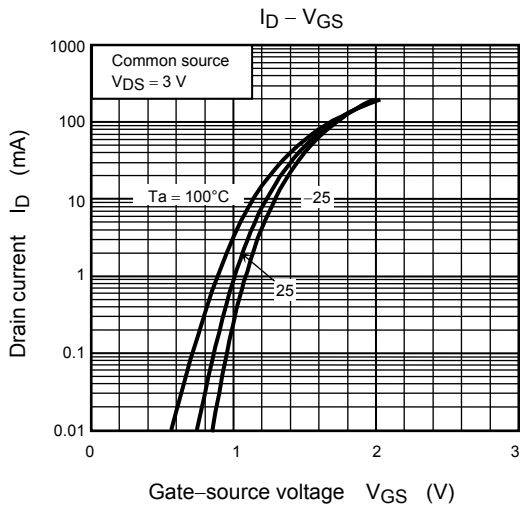
NPN





Nch-MOS





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