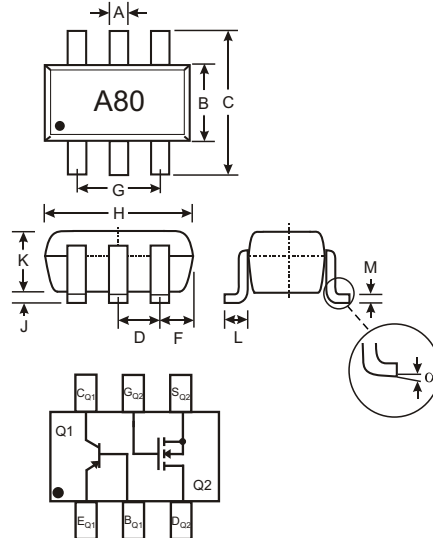


**Features**

- Combines MMBT4403 type transistor with 2N7002 type MOSFET
- Small Surface Mount Package
- NPN/P-Channel Complement Available: CTA2N1P
- Lead Free/RoHS Compliant (Note 1)

**Mechanical Data**

- Case: SOT-363
- Case Material: Molded Plastic. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020C
- Terminals: Solderable per MIL-STD-202, Method 208
- Lead Free Plating (Matte Tin Finish annealed over Alloy 42 leadframe).
- Terminal Connections: See Diagram
- Marking: A80, See Page 3
- Ordering Information: See Page 3
- Weight: 0.006 grams (approx.)



SOT-363		
Dim	Min	Max
A	0.10	0.30
B	1.15	1.35
C	2.00	2.20
D	0.65 Nominal	
F	0.30	0.40
H	1.80	2.20
J		0.10
K	0.90	1.00
L	0.25	0.40
M	0.10	0.25
	0	8°
All Dimensions in mm		

**Maximum Ratings, Total Device @ TA = 25 C unless otherwise specified**

Characteristic	Symbol	Value	Unit
Power Dissipation (Note 2)	$P_d$	150	mW
Thermal Resistance, Junction to Ambient (Note 2)	$R_{JA}$	833	C/W
Operating and Storage and Temperature Range	$T_j, T_{STG}$	-55 to +150	C

**Maximum Ratings, Q1, MMBT4403 PNP Transistor Element @ TA = 25 C unless otherwise specified**

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	$V_{CBO}$	-40	V
Collector-Emitter Voltage	$V_{CEO}$	-40	V
Emitter-Base Voltage	$V_{EBO}$	-5.0	V
Collector Current - Continuous	$I_C$	-600	mA

**Maximum Ratings, Q2, 2N7002 N-Channel MOSFET Element @ TA = 25 C unless otherwise specified**

Characteristic	Symbol	Value	Units
Drain-Source Voltage	$V_{DSS}$	60	V
Drain-Gate Voltage $R_{GS} = 1.0M$	$V_{DGR}$	60	V
Gate-Source Voltage	$V_{GSS}$	$\pm 20$	V
		$\pm 40$	
Drain Current (Note 2)	$I_D$	115	mA
		73	
		800	

Notes: 1. No purposefully added lead.

## Electrical Characteristics, Q1, MMBT4403 PNP Transistor Element

@ T<sub>A</sub> = 25 C unless otherwise specified

Characteristic	Symbol	Min	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 3)</b>					
Collector-Base Breakdown Voltage	V <sub>(BR)CBO</sub>	-40		V	I <sub>C</sub> = -100 A, I <sub>E</sub> = 0
Collector-Emitter Breakdown Voltage	V <sub>(BR)CEO</sub>	-40		V	I <sub>C</sub> = -1.0mA, I <sub>B</sub> = 0
Emitter-Base Breakdown Voltage	V <sub>(BR)EBO</sub>	-5.0		V	I <sub>E</sub> = -100 A, I <sub>C</sub> = 0
Collector Cutoff Current	I <sub>CEX</sub>		-100	nA	V <sub>CE</sub> = -35V, V <sub>EB(OFF)</sub> = -0.4V
Base Cutoff Current	I <sub>BL</sub>		-100	nA	V <sub>CE</sub> = -35V, V <sub>EB(OFF)</sub> = -0.4V
<b>ON CHARACTERISTICS (Note 3)</b>					
DC Current Gain	h <sub>FE</sub>	30 60 100 100 20	300		I <sub>C</sub> = -100μA, V <sub>CE</sub> = -1.0V I <sub>C</sub> = -1.0mA, V <sub>CE</sub> = -1.0V I <sub>C</sub> = -10mA, V <sub>CE</sub> = -1.0V I <sub>C</sub> = -150mA, V <sub>CE</sub> = -2.0V I <sub>C</sub> = -500mA, V <sub>CE</sub> = -2.0V
Collector-Emitter Saturation Voltage	V <sub>CE(SAT)</sub>		-0.40 -0.75	V	I <sub>C</sub> = -150mA, I <sub>B</sub> = -15mA I <sub>C</sub> = -500mA, I <sub>B</sub> = -50mA
Base-Emitter Saturation Voltage	V <sub>BE(SAT)</sub>	-0.75	-0.95 -1.30	V	I <sub>C</sub> = -150mA, I <sub>B</sub> = -15mA I <sub>C</sub> = -500mA, I <sub>B</sub> = -50mA
<b>SMALL SIGNAL CHARACTERISTICS</b>					
Output Capacitance	C <sub>cb</sub>		8.5	pF	V <sub>CB</sub> = -10V, f = 1.0MHz, I <sub>E</sub> = 0
Input Capacitance	C <sub>eb</sub>		30	pF	V <sub>EB</sub> = -0.5V, f = 1.0MHz, I <sub>C</sub> = 0
Input Impedance	h <sub>ie</sub>	1.5	15	k	V <sub>CE</sub> = -10V, I <sub>C</sub> = -1.0mA, f = 1.0kHz
Voltage Feedback Ratio	h <sub>re</sub>	0.1	8.0	x 10 <sup>-4</sup>	
Small Signal Current Gain	h <sub>fe</sub>	60	500		
Output Admittance	h <sub>oe</sub>	1.0	100	S	
Current Gain-Bandwidth Product	f <sub>T</sub>	200		MHz	V <sub>CE</sub> = -10V, I <sub>C</sub> = -20mA, f = 100MHz
<b>SWITCHING CHARACTERISTICS</b>					
Delay Time	t <sub>d</sub>		15	ns	V <sub>CC</sub> = -30V, I <sub>C</sub> = -150mA, V <sub>BE(off)</sub> = -2.0V, I <sub>B1</sub> = -15mA
Rise Time	t <sub>r</sub>		20	ns	
Storage Time	t <sub>s</sub>		225	ns	V <sub>CC</sub> = -30V, I <sub>C</sub> = -150mA, I <sub>B1</sub> = I <sub>B2</sub> = -15mA
Fall Time	t <sub>f</sub>		30	ns	

## Electrical Characteristics, Q2, 2N7002 N-Channel MOSFET Element

@ T<sub>A</sub> = 25 C unless otherwise specified

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 3)</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	60	70		V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 10 A
Zero Gate Voltage Drain Current	I <sub>DSS</sub>			1.0 500	μA	V <sub>DS</sub> = 60V, V <sub>GS</sub> = 0V @ T <sub>C</sub> = 25°C @ T <sub>C</sub> = 125°C
Gate-Body Leakage	I <sub>GSS</sub>			±10	nA	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS (Note 3)</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	1.0		2.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250 A
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>		3.2 4.4	7.5 13.5		V <sub>GS</sub> = 5.0V, I <sub>D</sub> = 0.05A V <sub>GS</sub> = 10V, I <sub>D</sub> = 0.5A @ T <sub>J</sub> = 25°C @ T <sub>J</sub> = 125°C
On-State Drain Current	I <sub>D(ON)</sub>	0.5	1.0		A	V <sub>GS</sub> = 10V, V <sub>DS</sub> = 7.5V
Forward Transconductance	g <sub>FS</sub>	80			mS	V <sub>DS</sub> = 10V, I <sub>D</sub> = 0.2A
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	C <sub>iss</sub>		22	50	pF	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V f = 1.0MHz
Output Capacitance	C <sub>oss</sub>		11	25	pF	
Reverse Transfer Capacitance	C <sub>rss</sub>		2.0	5.0	pF	
<b>SWITCHING CHARACTERISTICS</b>						
Turn-On Delay Time	t <sub>D(ON)</sub>		7.0	20	ns	V <sub>DD</sub> = 30V, I <sub>D</sub> = 0.2A, R <sub>L</sub> = 150 Ω, V <sub>GEN</sub> = 10V, R <sub>GEN</sub> = 25 Ω
Turn-Off Delay Time	t <sub>D(OFF)</sub>		11	20	ns	

Note: 2. Device mounted on FR-4 PCB; pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at <http://www.diodes.com/datasheets/ap02001.pdf>.

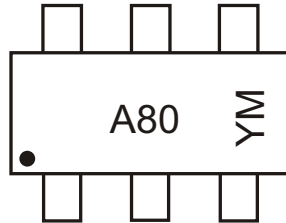
3. Short test pulse used to minimize self-heating effect.

**Ordering Information** (Note 4)

Device	Packaging	Shipping
CTA2P1N-7-F	SOT-363	3000/Tape & Reel

Notes: 4. For Packaging Details, go to our website at <http://www.diodes.com/datasheets/ap02007.pdf>.

**Marking Information**



A80 = Product Type Marking Code  
 YM = Date Code Marking  
 Y = Year ex: N = 2002  
 M = Month ex: 9 = September

Date Code Key

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009
Code	M	N	P	R	S	T	U	V	W

Month	Jan	Feb	March	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Code	1	2	3	4	5	6	7	8	9	O	N	D

MMBT4403 Section

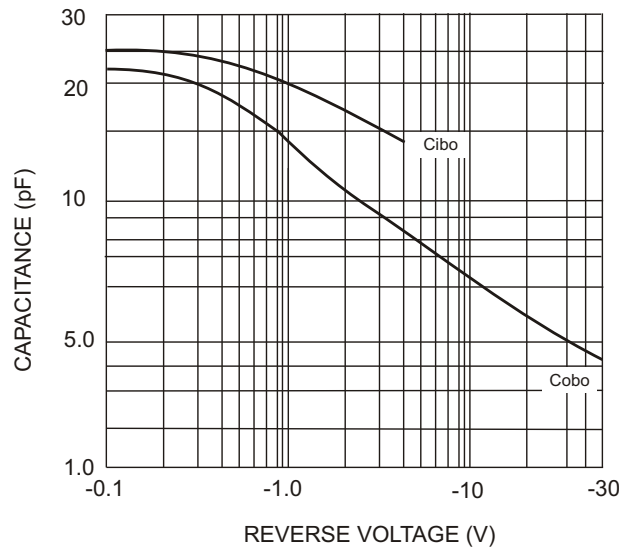


Fig. 1 Typical Capacitance

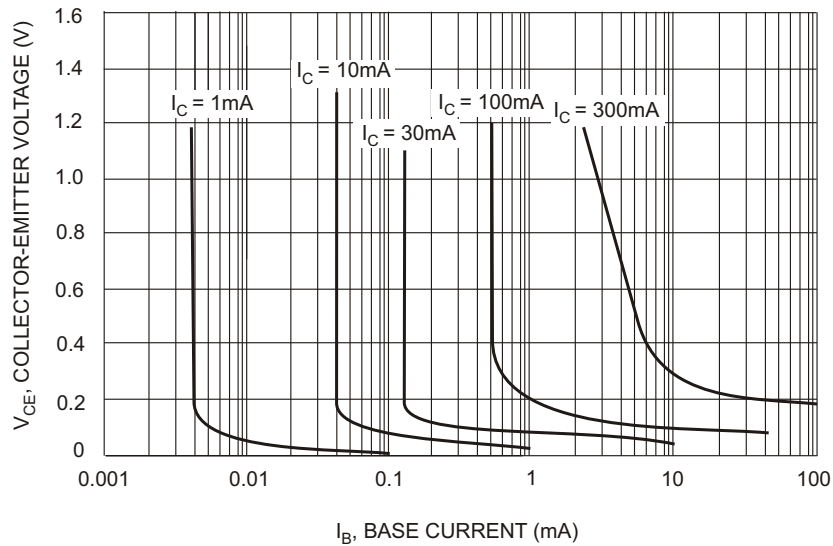


Fig. 2 Typical Collector Saturation Region

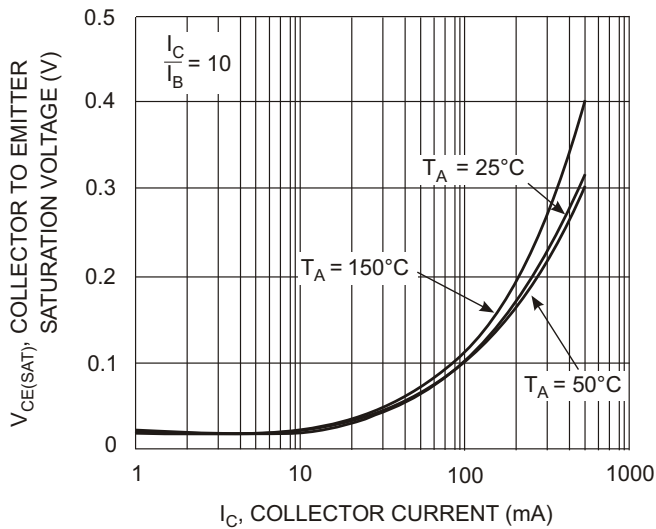


Fig. 3 Collector Emitter Saturation Voltage vs. Collector Current

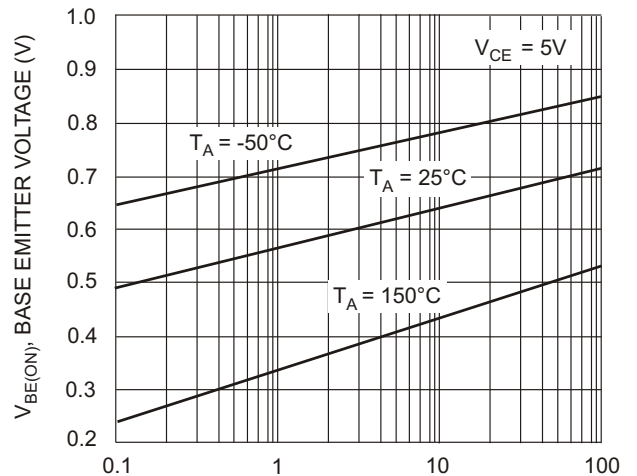


Fig. 4 Base-Emitter Voltage vs. Collector Current

**MMBT4403 Section**

**NEW PRODUCT**

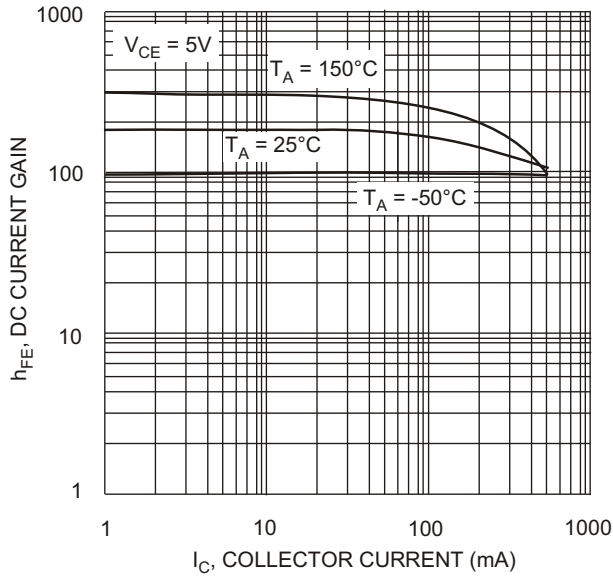


Fig. 5 DC Current Gain vs. Collector Current

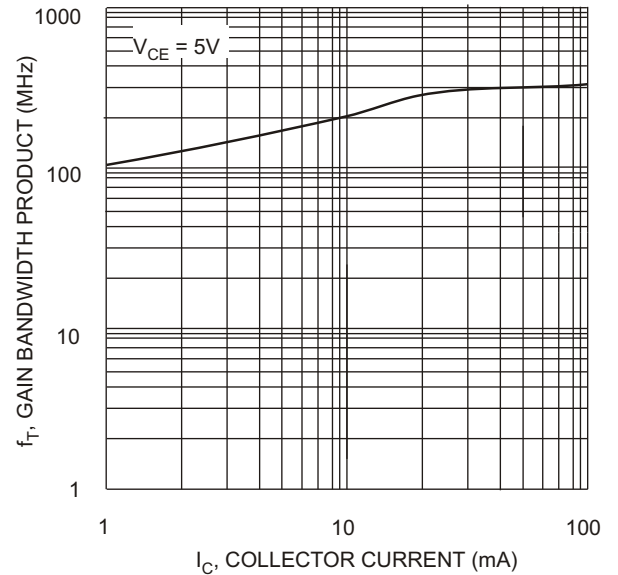


Fig. 6 Gain Bandwidth Product vs. Collector Current

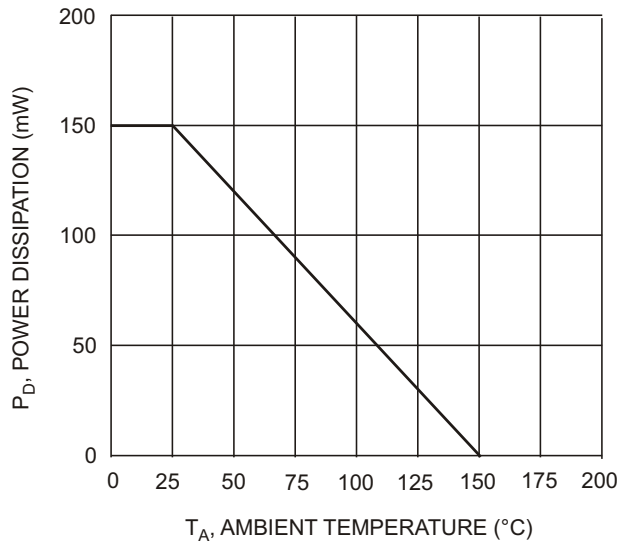


Fig. 7 Max Power Dissipation vs Ambient Temperature (Total Device)

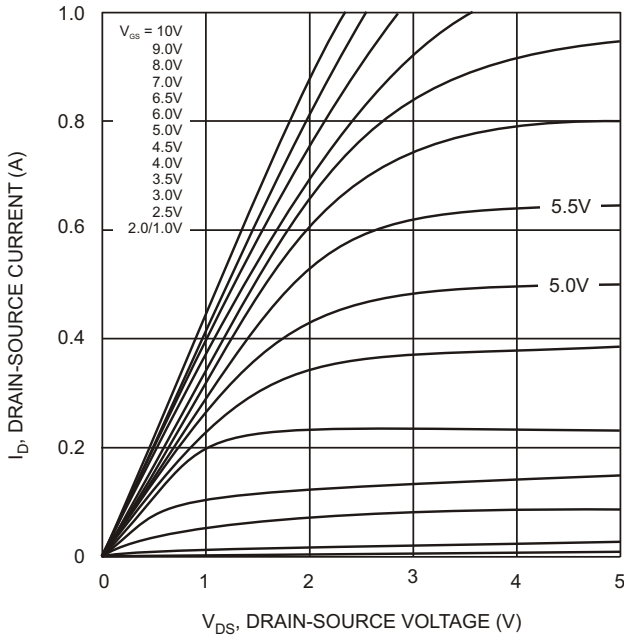


Fig. 8 On-Region Characteristics (2N7002)

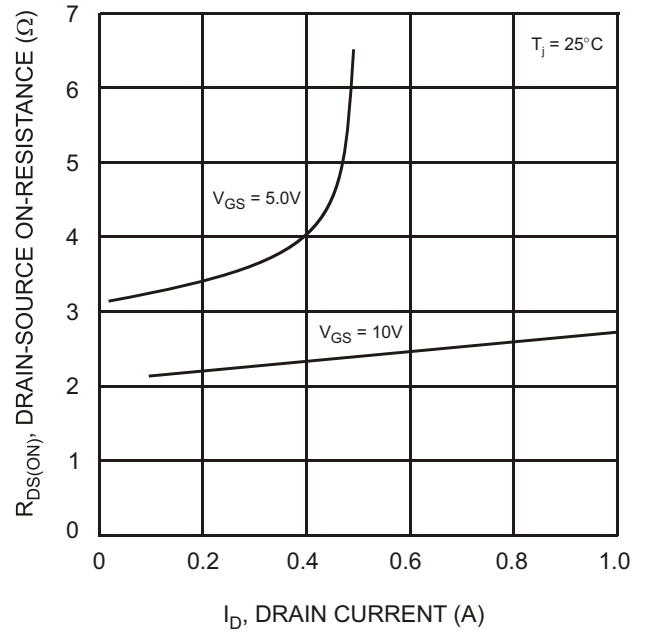


Fig. 9 On-Resistance vs Drain Current (2N7002)

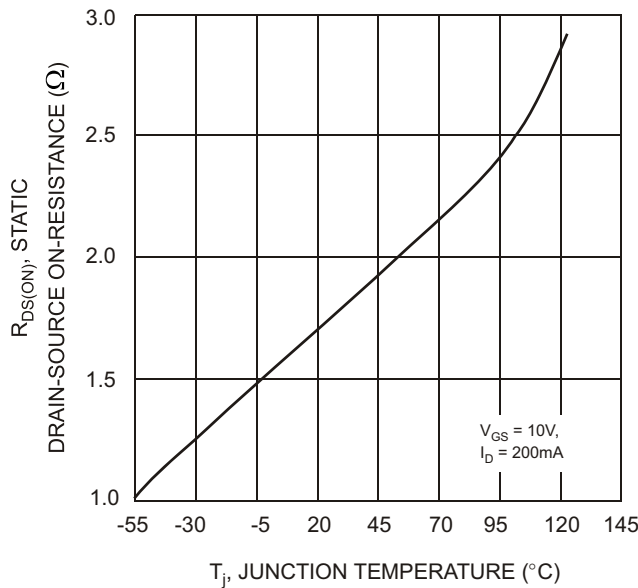


Fig. 10 On-Resistance vs Junction Temperature (2N7002)

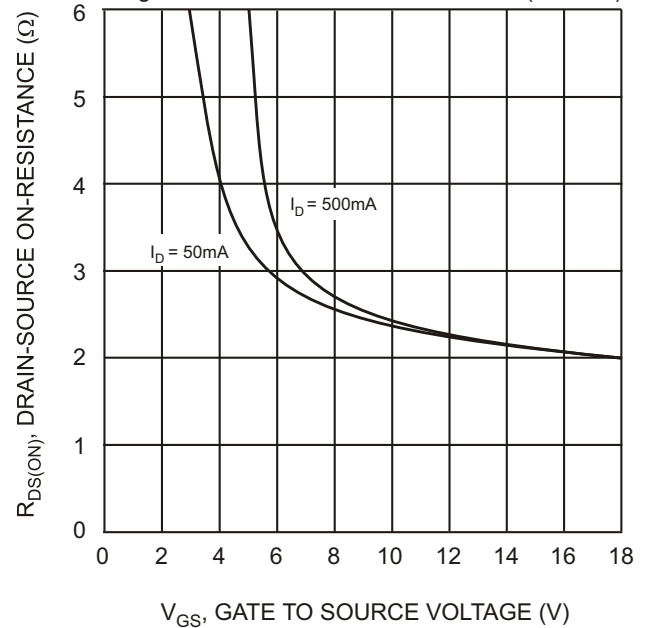


Fig. 11 On-Resistance vs. Gate-Source Voltage (2N7002)

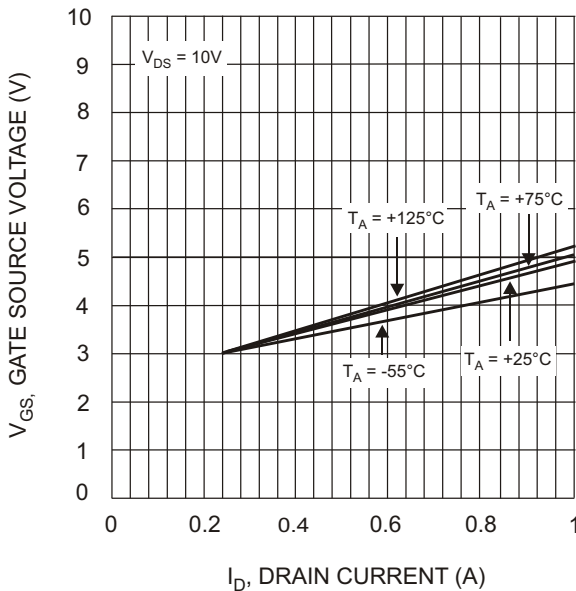


Fig. 12 Typical Transfer Characteristics (2N7002)

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