EMD9FHA / UMD9NFHA / IMD9AFRA

NPN + PNP Complex Digital Transistors (Bias Resistor Built-in Transistors) Datasheet

AEC-Q101 Qualified

<For DTr1(NPN)>

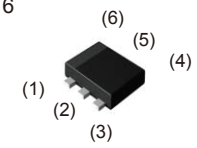
Parameter	Value
V_{CC}	50V
$I_{C(MAX.)}$	100mA
R_1	10kΩ
R_2	47kΩ

<For DTr2(PNP)>

Parameter	Value
V_{CC}	−50V
$I_{C(MAX.)}$	−100mA
R_1	10kΩ
R_2	47kΩ

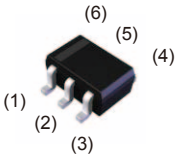
●Outline

EMT6



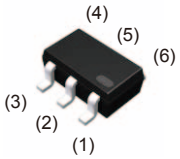
EMD9FHA
(SC-107C)

UMT6



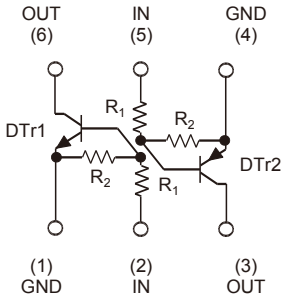
UMD9NFHA
SOT-353 (SC-88)

SMT6

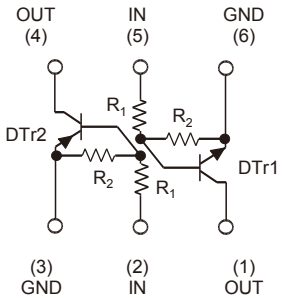


IMD9AFRA
SOT-457 (SC-74)

●Inner circuit



EMD9FHA / UMD9NFHA



IMD9AFRA

●Features

1) Both the DTC114Y chip and DTA114Y chip in one package.
2) Built-in bias resistors enable the configuration of an inverter circuit without connecting external input resistors (see inner circuit).
3) The bias resistors consist of thin-film resistors with complete isolation to allow negative biasing of the input. They also have the advantage of completely eliminating parasitic effects.
4) Only the on/off conditions need to be set for operation, making the circuit design easy.
5) Lead Free/RoHS Compliant.

●Application

Inverter circuit, Interface circuit, Driver circuit

●Packaging specifications

Part No.	Package	Package size (mm)	Taping code	Reel size (mm)	Tape width (mm)	Basic ordering unit (pcs)	Marking
EMD9FHA	EMT6	1616	T2R	180	8	8,000	D9
UMD9NFHA	UMT6	2021	TR	180	8	3,000	D9
IMD9AFRA	SMT6	2928	T108	180	8	3,000	D9

●**Absolute maximum ratings** (Ta = 25°C)

Parameter		Symbol	DTr1(NPN)	DTr2(PNP)	Unit
Supply voltage		V_{CC}	50	−50	V
Input voltage		V_{IN}	−6 to +40	−40 to +6	V
Output current		I_O	70	−70	mA
Collector current		$I_{C(MAX.)}$ *1	100	−100	mA
Power dissipation	EMD9FHA / UMD9NFHA	P_D *2	150 (Total) *3		mW
	IMD9AFRA		300 (Total) *4		mW
Junction temperature		T_j	150		°C
Range of storage temperature		T_{stg}	−55 to +150		°C

●**Electrical characteristics**(Ta = 25°C) <For DTr1(NPN)>

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input voltage	$V_{I(off)}$	V_{CC} = 5V, I_O = 100μA	-	-	0.3	V
	$V_{I(on)}$	V_O = 0.3V, I_O = 1mA	1.4	-	-	
Output voltage	$V_{O(on)}$	I_O / I_I = 5mA / 0.25mA	-	0.1	0.3	V
Input current	I_I	V_I = 5V	-	-	0.88	mA
Output current	$I_{O(off)}$	V_{CC} = 50V, V_I = 0V	-	-	0.5	μA
DC current gain	G_I	V_O = 5V, I_O = 5mA	68	-	-	-
Input resistance	R_1	-	7	10	13	kΩ
Resistance ratio	R_2/R_1	-	3.7	4.7	5.7	-
Transition frequency	f_T *1	V_{CE} = 10V, I_E = −5mA f = 100MHz	-	250	-	MHz

●**Electrical characteristics**(Ta = 25°C) <For DTr2(PNP)>

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input voltage	$V_{I(off)}$	V_{CC} = −5V, I_O = −100μA	-	-	−0.3	V
	$V_{I(on)}$	V_O = −0.3V, I_O = −1mA	−1.4	-	-	
Output voltage	$V_{O(on)}$	I_O / I_I = −5mA / −0.25mA	-	−0.1	−0.3	V
Input current	I_I	V_I = −5V	-	-	−0.88	mA
Output current	$I_{O(off)}$	V_{CC} = −50V, V_I = 0V	-	-	−0.5	μA
DC current gain	G_I	V_O = −5V, I_O = −5mA	68	-	-	-
Input resistance	R_1	-	7	10	13	kΩ
Resistance ratio	R_2/R_1	-	3.7	4.7	5.7	-
Transition frequency	f_T *1	V_{CE} = −10V, I_E = 5mA f = 100MHz	-	250	-	MHz

*1 Characteristics of built-in transistor

*2 Each terminal mounted on a reference footprint

*3 120mW per element must not be exceeded.

*4 200mW per element must not be exceeded.

●**Electrical characteristic curves** (Ta = 25°C) <For DTr1(NPN)>

Fig.1 Input voltage vs. output current (ON characteristics)

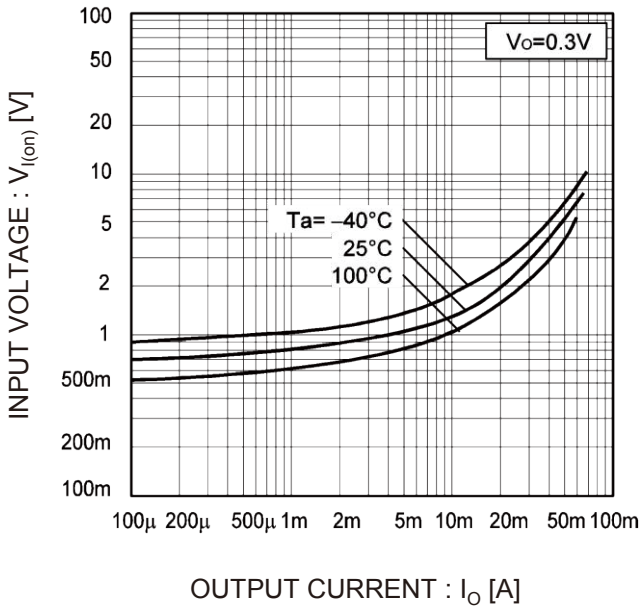


Fig.2 Output current vs. input voltage (OFF characteristics)

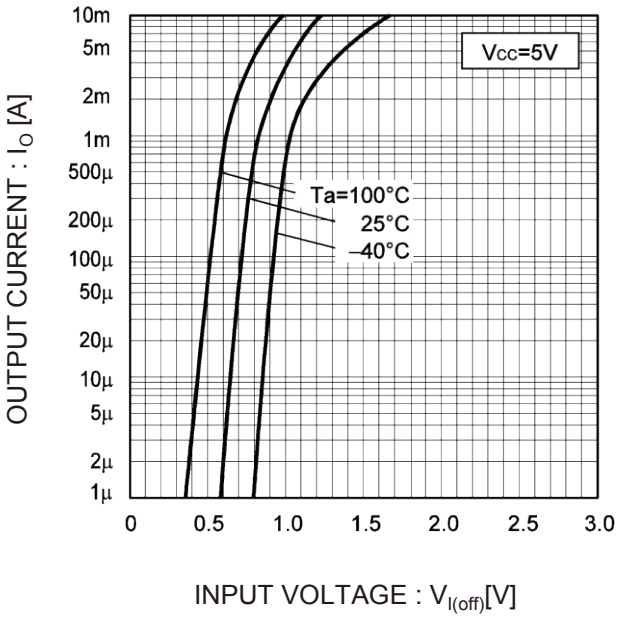


Fig.3 Output current vs. output voltage

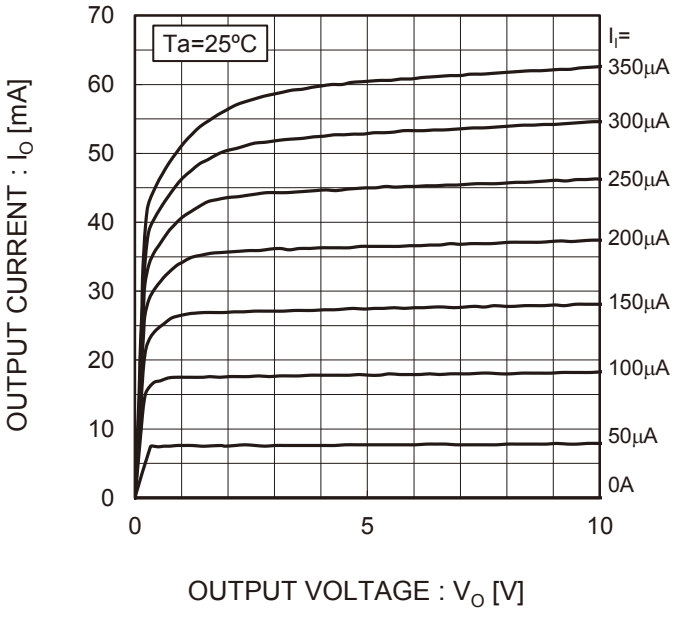
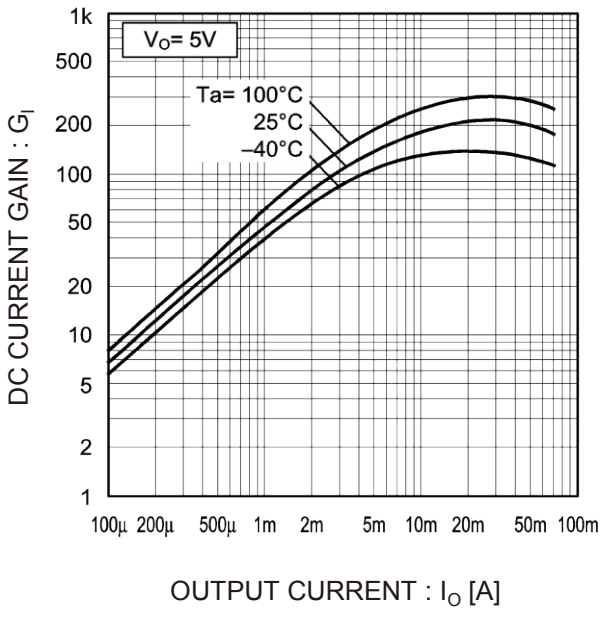
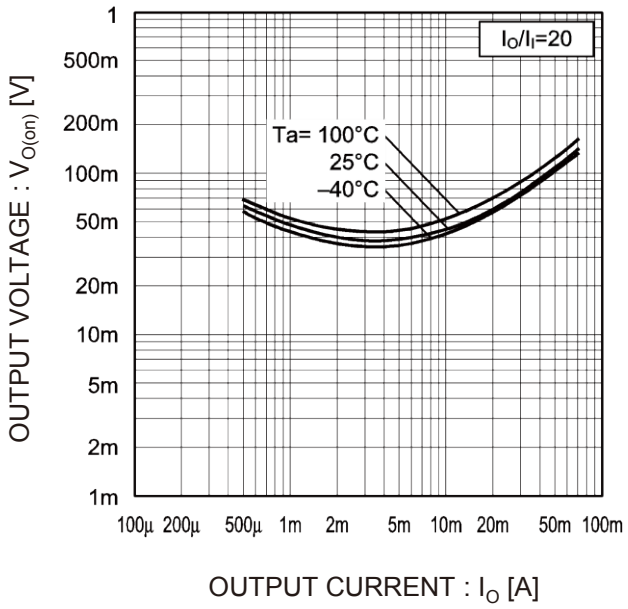


Fig.4 DC current gain vs. output current



●**Electrical characteristic curves** (Ta = 25°C) <For DTr1(NPN)>

Fig.5 Output voltage vs. output current



●**Electrical characteristic curves** (Ta = 25°C) <For DTr2(PNP)>

Fig.6 Input voltage vs. output current (ON characteristics)

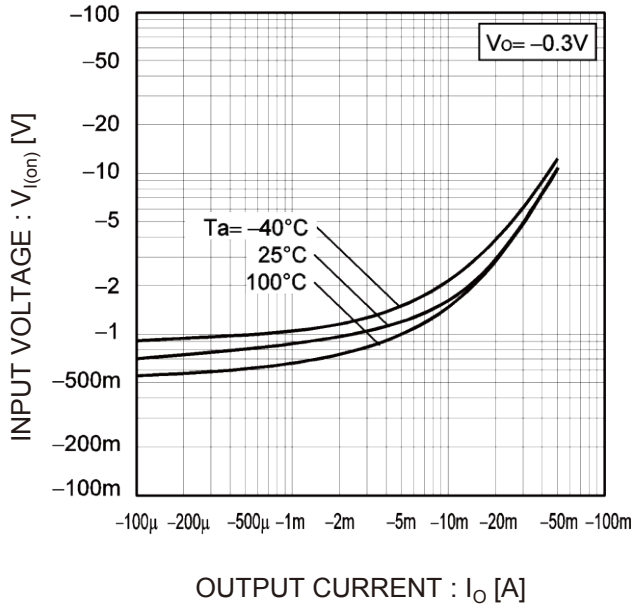
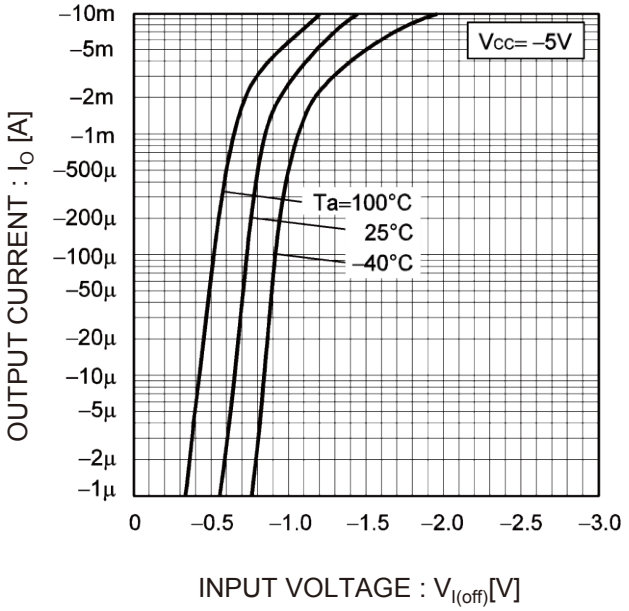


Fig.7 Output current vs. input voltage (OFF characteristics)



●**Electrical characteristic curves** (Ta = 25°C) <For DTr2(PNP)>

Fig.8 Output current vs. output voltage

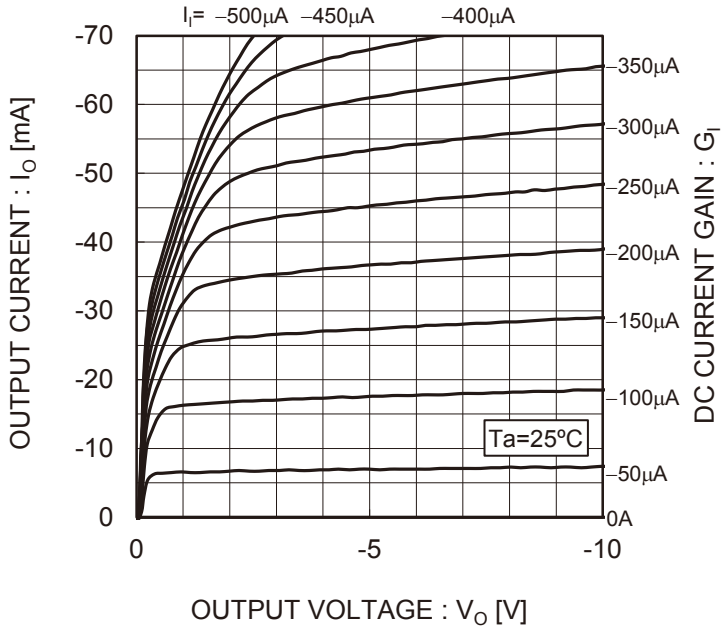


Fig.9 DC current gain vs. output current

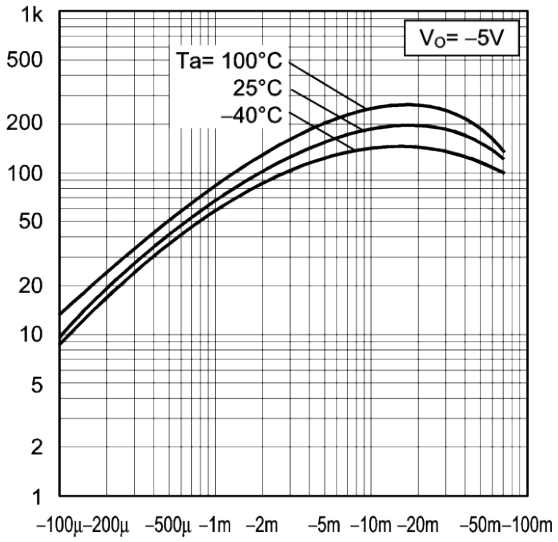
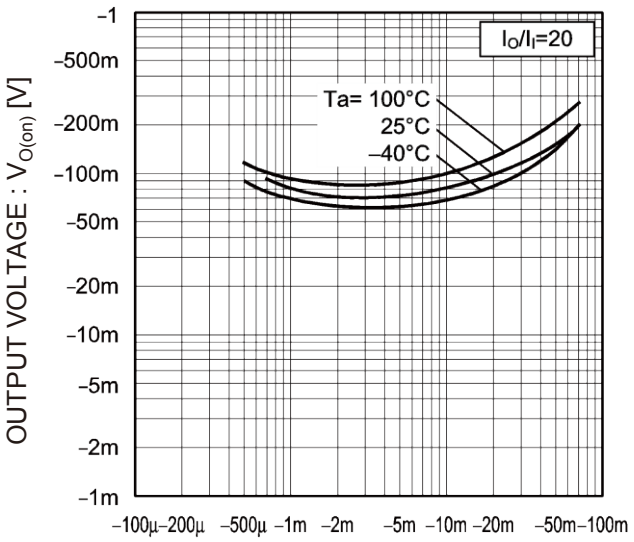
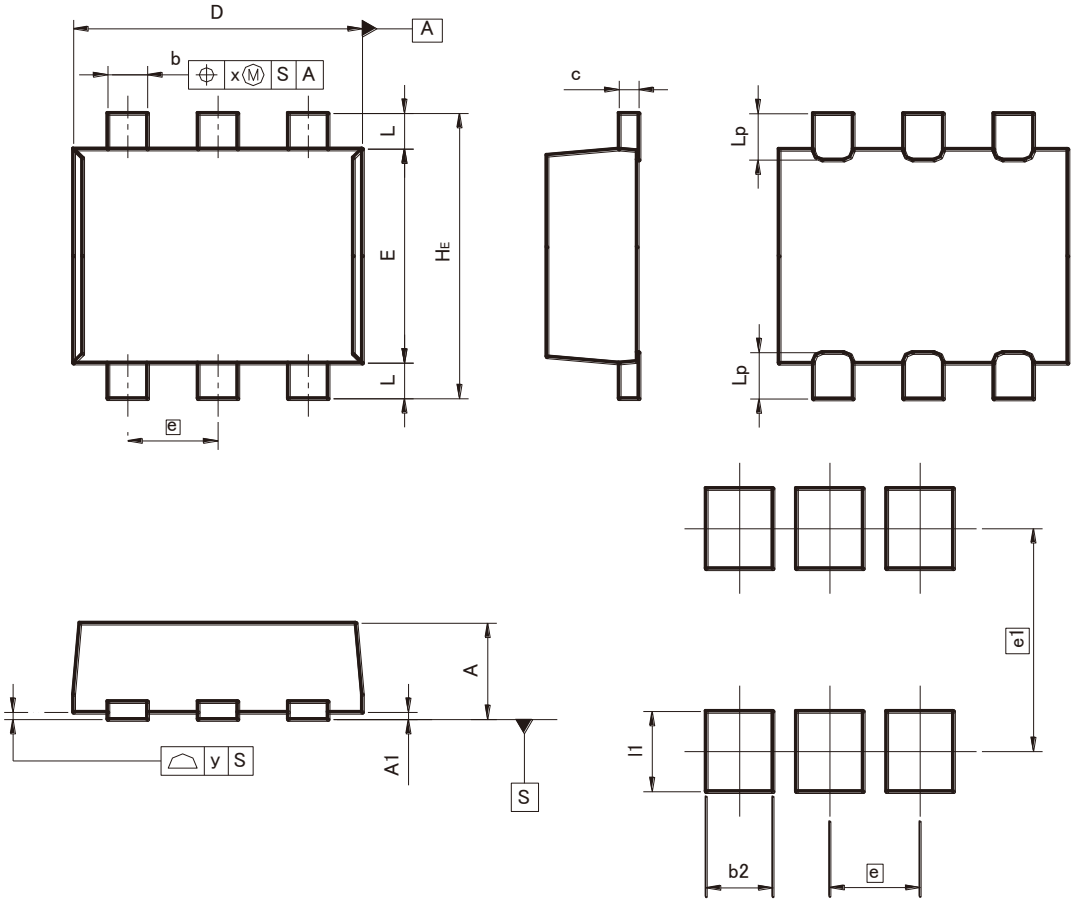


Fig.10 Output voltage vs. output current



●**Dimensions** (Unit : mm)

EMT6



Pattern of terminal position areas
[Not a recommended pattern of soldering pads]

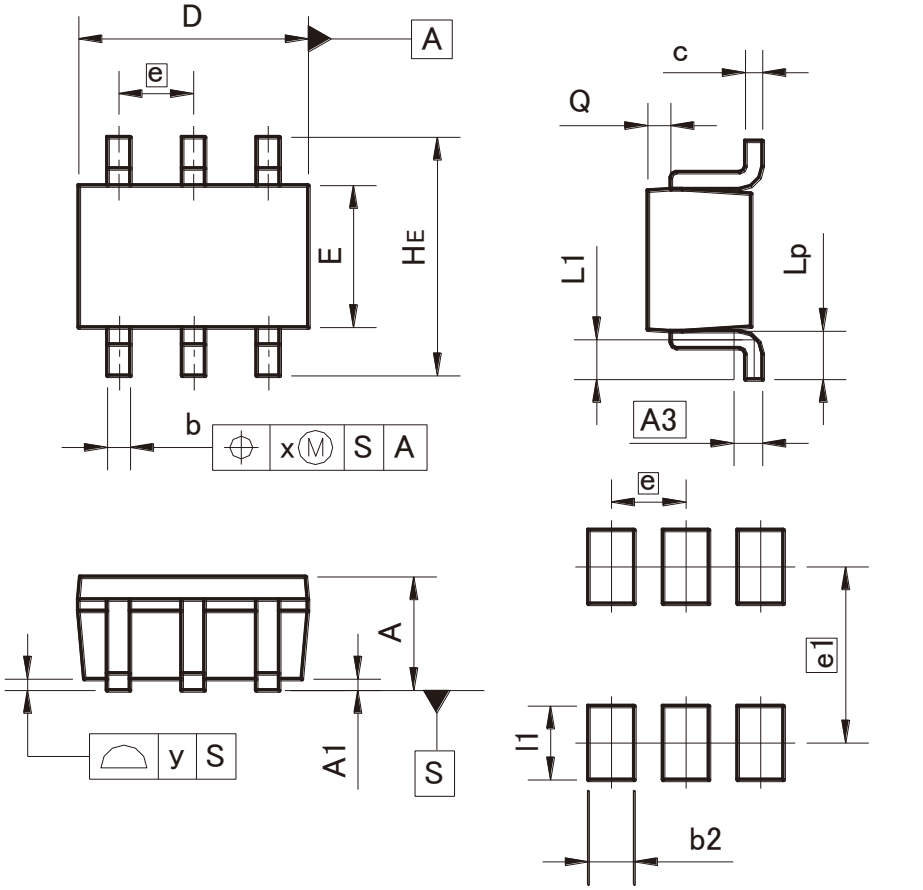
DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.45	0.55	0.018	0.022
A1	0.00	0.10	0.000	0.004
b	0.17	0.27	0.007	0.011
c	0.08	0.18	0.003	0.007
D	1.50	1.70	0.059	0.067
E	1.10	1.30	0.043	0.051
e	0.50		0.020	
HE	1.50	1.70	0.059	0.067
L	0.10	0.30	0.004	0.012
Lp	−	0.35	−	0.014
x	−	0.10	−	0.004
y	−	0.10	−	0.004

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
b2	−	0.37	−	0.015
e1	1.25		0.049	
l1	−	0.45	−	0.018

Dimension in mm / inches

●**Dimensions** (Unit : mm)

UMT6



Pattern of terminal position areas
[Not a recommended pattern of soldering pads]

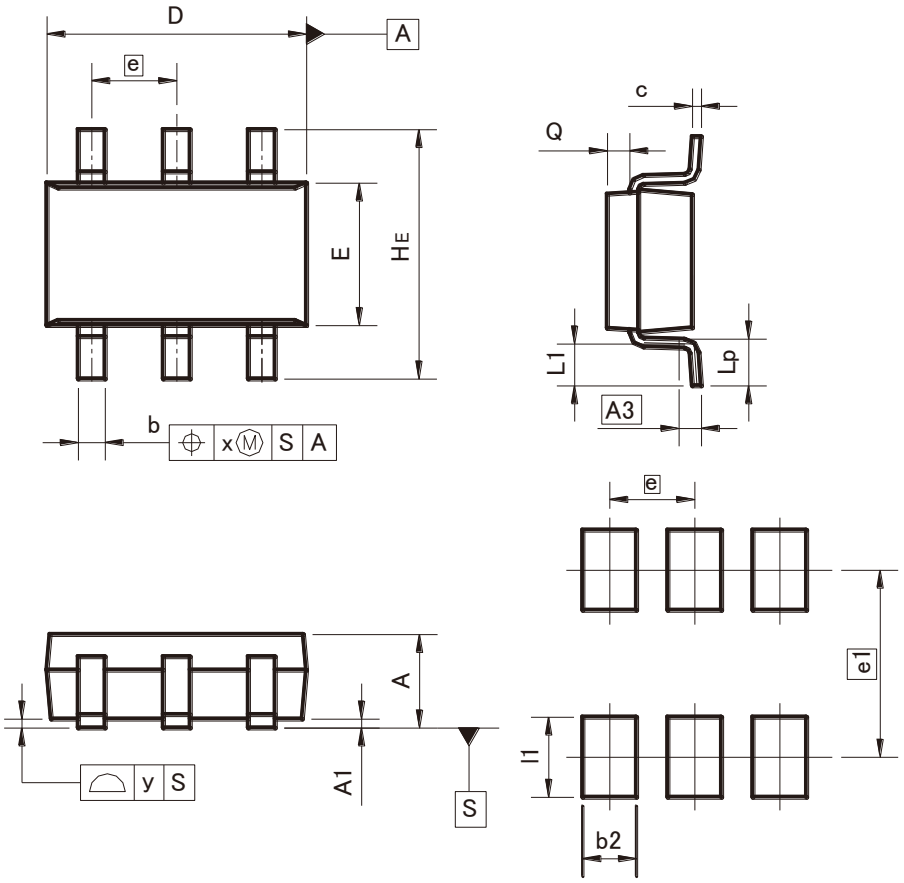
DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.80	1.00	0.031	0.039
A1	0.00	0.10	0.000	0.004
A3	0.25		0.010	
b	0.15	0.30	0.006	0.012
c	0.10	0.20	0.004	0.008
D	1.90	2.10	0.075	0.083
E	1.15	1.35	0.045	0.053
e	0.65		0.026	
HE	2.00	2.20	0.079	0.087
L1	0.20	0.50	0.008	0.020
Lp	0.25	0.55	0.010	0.022
Q	0.10	0.30	0.004	0.012
x	–	0.10	–	0.004
y	–	0.10	–	0.004

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
b2	–	0.40	–	0.016
e1	1.55		0.061	
l1	–	0.65	–	0.026

Dimension in mm / inches

●**Dimensions** (Unit : mm)

SMT6



Pattern of terminal position areas
[Not a recommended pattern of soldering pads]

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.00	1.30	0.039	0.051
A1	0.00	0.10	0.000	0.004
A3	0.25		0.010	
b	0.25	0.40	0.010	0.016
c	0.09	0.25	0.004	0.010
D	2.80	3.00	0.110	0.118
E	1.50	1.80	0.059	0.071
e	0.95		0.037	
HE	2.60	3.00	0.102	0.118
L1	0.30	0.60	0.012	0.024
Lp	0.40	0.70	0.016	0.028
Q	0.20	0.30	0.008	0.012
x	−	0.20	−	0.008
y	−	0.10	−	0.004

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
b2		0.60	−	0.024
e1	2.10		0.083	
l1	−	0.90	−	0.035

Dimension in mm / inches

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