

To our customers,

Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: <http://www.renesas.com>

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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Not recommended
for new design

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MOSFET WITH SCHOTTKY BARRIER DIODE

μ PA2680T1E

**N-CHANNEL MOSFET WITH SCHOTTKY BARRIER DIODE
FOR SWITCHING**

DESCRIPTION

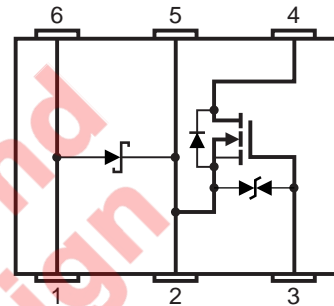
The μPA2680T1E is a switching device, which can be driven directly by a 4.5 V power source.

The μPA2680T1E incorporates a MOSFET which features a low on-state resistance and excellent switching characteristics and a low forward voltage Schottky Barrier Diode, and is suitable for applications such as DC/DC converter of portable machine and so on.

FEATURES

- 4.5 V drive available MOSFET
- Low on-state resistance MOSFET
 $R_{DS(on)1} = 38 \text{ m}\Omega \text{ TYP. (} V_{GS} = 10 \text{ V, } I_D = 3.0 \text{ A)}$
 $R_{DS(on)2} = 44 \text{ m}\Omega \text{ TYP. (} V_{GS} = 4.5 \text{ V, } I_D = 3.0 \text{ A)}$
- Low forward voltage Schottky Barrier Diode
 $V_F = 0.36 \text{ V TYP. (} I_F = 1.0 \text{ A)}$

PIN CONNECTION (Top View)



- 1: Anode
- 2: Source/Cathode (Heat sink 2)
- 3: Gate
- 4: Drain (Heat sink 1)
- 5: Source/Cathode (Heat sink 2)
- 6: Anode

ORDERING INFORMATION

PART NUMBER	PACKAGE
μPA2680T1E	6LD3x3MLP

Marking: **A2680**

Remark The diode connected between the gate and source of the transistor serves as a protector against ESD. When this device actually used, an additional protection circuit is externally required if a voltage exceeding the rated voltage may be applied to this device.

Caution This product is electrostatic-sensitive device due to low ESD capability and should be handled with caution for electrostatic discharge.

$V_{ESD} = \pm 150 \text{ V TYP. (} C = 200 \text{ pF, } R = 0 \text{ }\Omega, \text{ Single Pulse)}$

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ABSOLUTE MAXIMUM RATINGS (TA = 25°C, unless otherwise specified)

MOSFET

Drain to Source Voltage (VGS = 0 V)	V _{DSS}	20	V
Gate to Source Voltage (VDS = 0 V)	V _{GSS}	±12	V
Drain Current (DC) ^{Note1}	I _{D(DC)}	±3.0	A
Drain Current (pulse) ^{Note2}	I _{D(pulse)}	±12.0	A
Total Power Dissipation ^{Note1}	P _T	1.3	W
Channel Temperature	T _{ch}	150	°C
Storage Temperature	T _{stg}	-55 to +150	°C

- Notes** 1. Mounted on a 1 in² pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick FR-4 board
 (Cu pad: 322 mm² x 70 μm, FR-4: 1452 mm² x 1.6 mmt)
 2. PW ≤ 10 μs, Duty Cycle ≤ 1%

Schottky Barrier Diode

Repetitive Peak Reverse Voltage	V _{RRM}	20	V
Average Forward Current ^{Note}	I _F	1.8	A
Total Power Dissipation ^{Note}	P _T	1.2	W
Junction Temperature	T _J	125	°C
Storage Temperature	T _{stg}	-55 to +150	°C

- Note** Square wave, Duty Cycle = 50%
 Mounted on a 1 in² pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick FR-4 board
 (Cu pad: 322 mm² x 70 μm, FR-4: 1452 mm² x 1.6 mmt)



SBD side: 85°C/W when mounted on a 1 in² pad of 2 oz copper

FET side: 97°C/W when mounted on a 1 in² pad of 2 oz copper

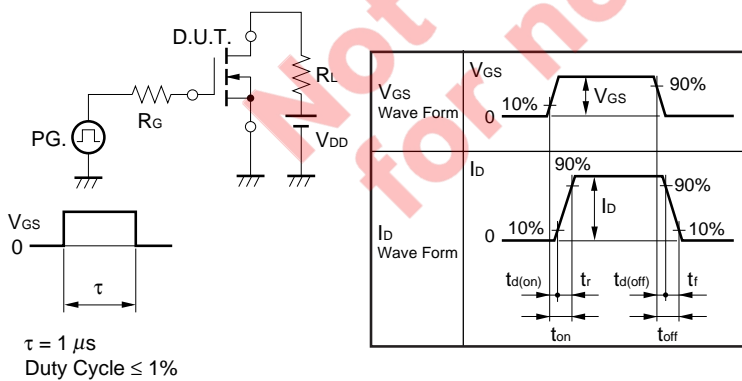
ELECTRICAL CHARACTERISTICS (TA = 25°C, unless otherwise specified)

MOSFET

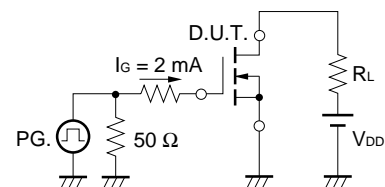
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 20 V, V _{GS} = 0 V			1	μA
Gate Leakage Current	I _{GSS}	V _{GS} = ±12 V, V _{DS} = 0 V			±10	μA
Gate to Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 0.25 mA	0.6		2.0	V
Forward Transfer Admittance ^{Note}	y _{fs}	V _{DS} = 10 V, I _D = 1.5 A	1.0	3.6		S
Drain to Source On-state Resistance ^{Note}	R _{DS(on)1}	V _{GS} = 10 V, I _D = 3.0 A		38	50	mΩ
	R _{DS(on)2}	V _{GS} = 4.5 V, I _D = 3.0 A		44	60	mΩ
Input Capacitance	C _{iss}	V _{DS} = 10 V,		190		pF
Output Capacitance	C _{oss}	V _{GS} = 0 V,		90		pF
Reverse Transfer Capacitance	C _{rss}	f = 1.0 MHz		33		pF
Turn-on Delay Time	t _{d(on)}	V _{DD} = 10 V, I _D = 1.5 A,		9.0		ns
Rise Time	t _r	V _{GS} = 4.5 V,		7.0		ns
Turn-off Delay Time	t _{d(off)}	R _G = 10 Ω		16		ns
Fall Time	t _f			4.0		ns
Total Gate Charge	Q _G	V _{DD} = 16 V,		3.1		nC
Gate to Source Charge	Q _{GS}	V _{GS} = 4.5 V,		0.6		nC
Gate to Drain Charge	Q _{GD}	I _D = 2.0 A		1.1		nC
Body Diode Forward Voltage ^{Note}	V _{F(S-D)}	I _F = 3.0 A, V _{GS} = 0 V		0.85		V

Note Pulsed: PW ≤ 350 μs, Duty Cycle ≤ 2%

TEST CIRCUIT 1 SWITCHING TIME



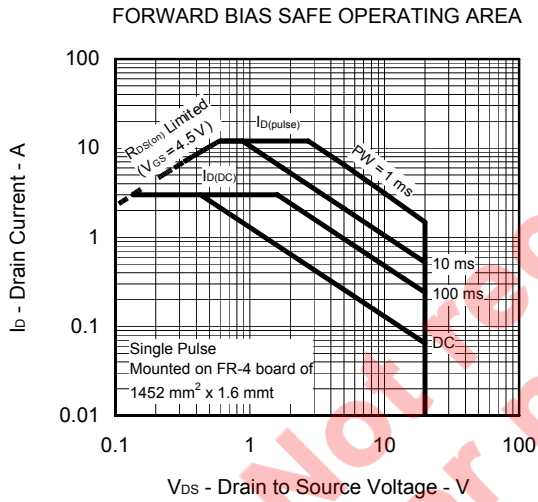
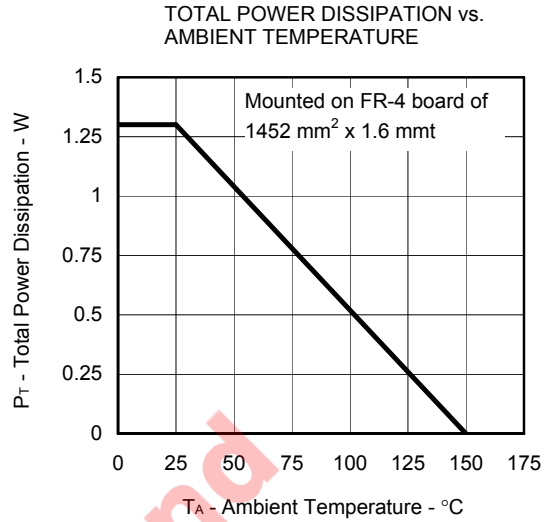
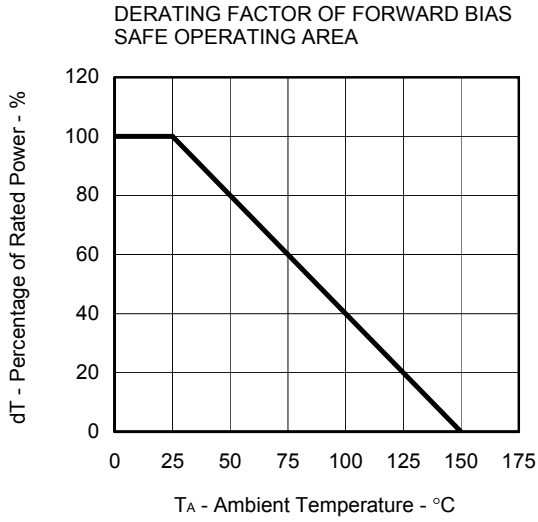
TEST CIRCUIT 2 GATE CHARGE



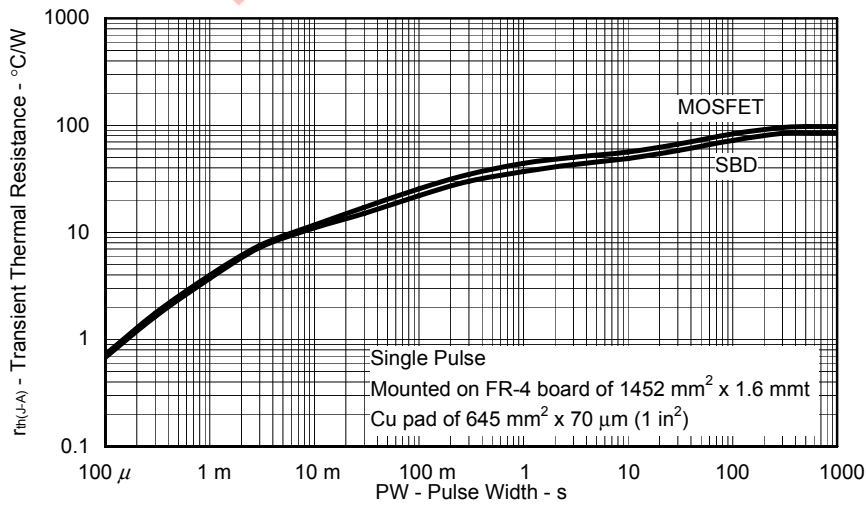
Schottky Barrier Diode

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Forward Voltage	V _F	I _F = 1.0 A		0.36	0.39	V
Reverse Current	I _R	V _R = 5 V, T _A = 100°C			15	mA
Terminal Capacitance	C _T	f = 1.0 MHz, V _R = 10 V		36		pF

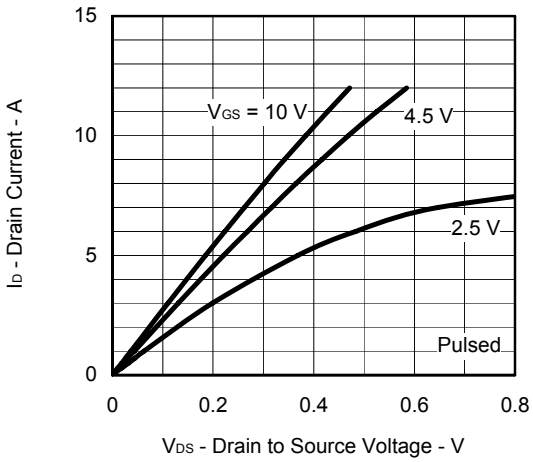
MOSFET TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise specified)



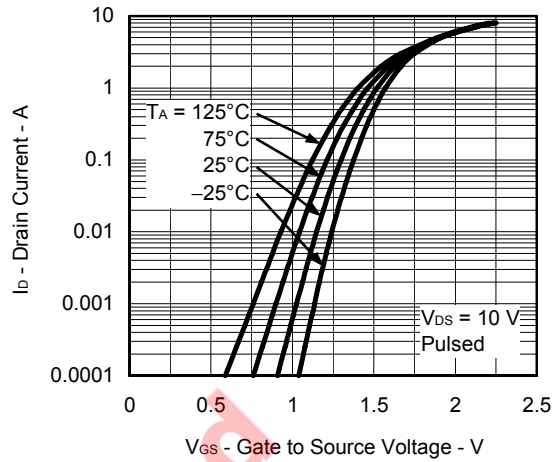
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



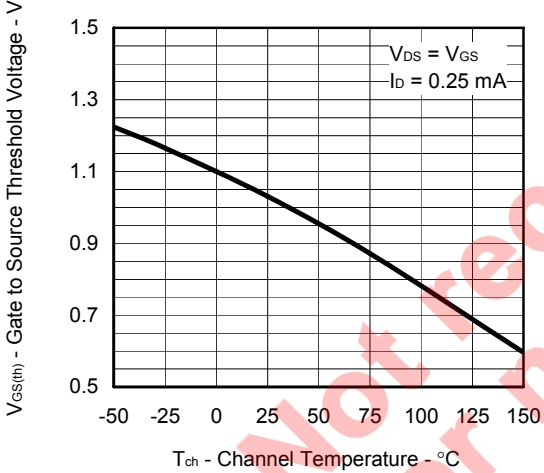
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



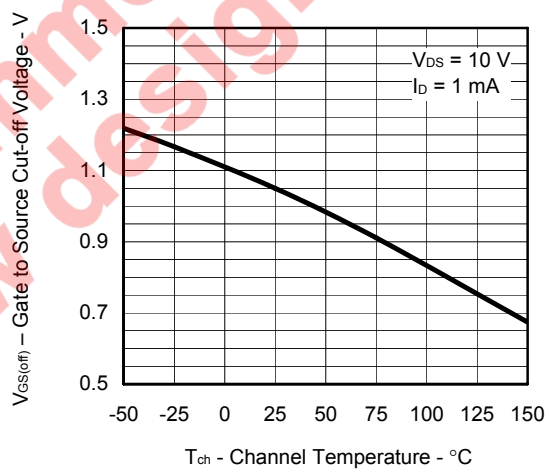
FORWARD TRANSFER CHARACTERISTICS



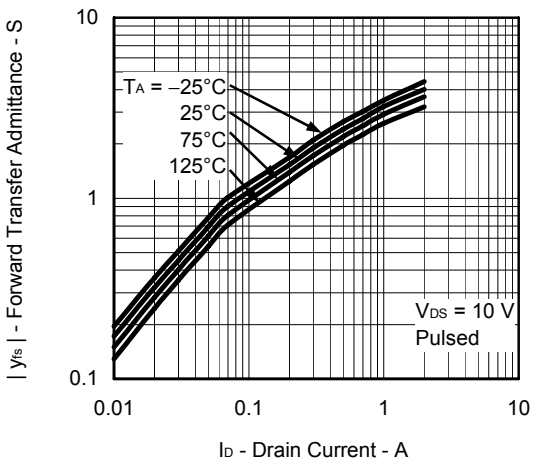
GATE TO SOURCE THRESHOLD VOLTAGE vs. CHANNEL TEMPERATURE



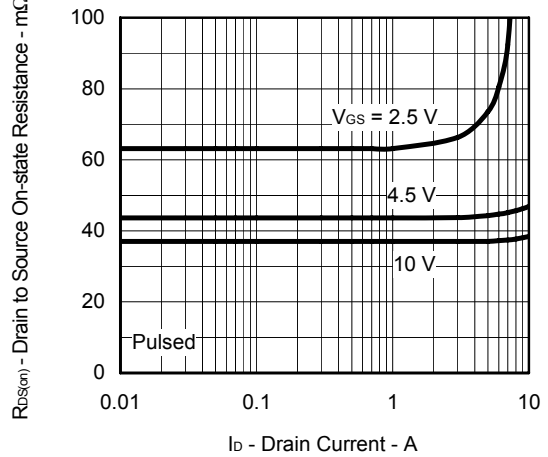
GATE TO SOURCE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



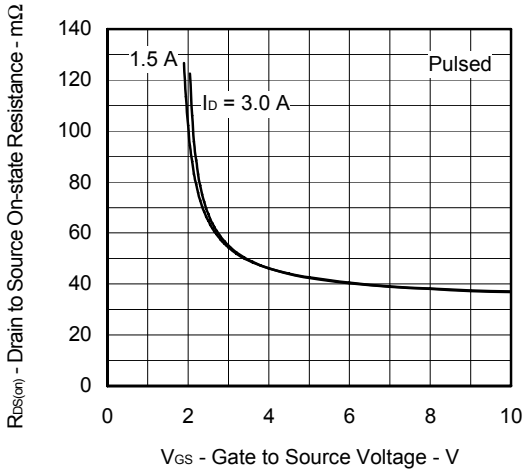
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



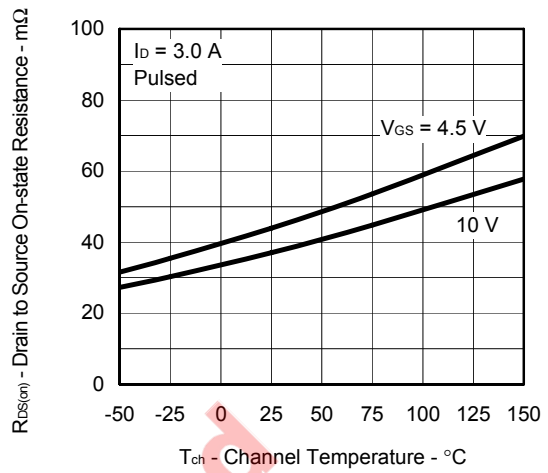
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



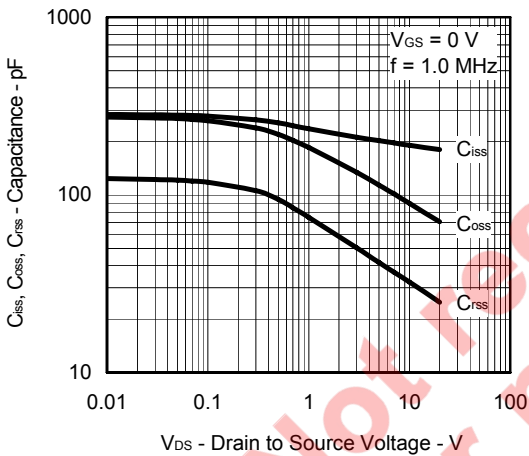
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



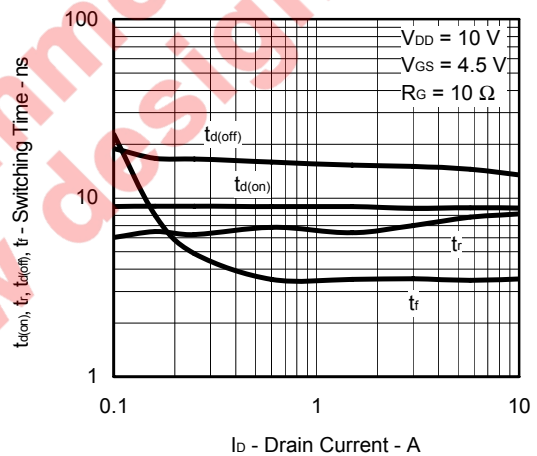
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



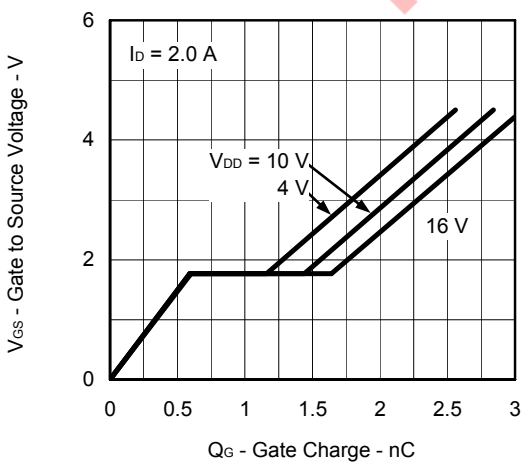
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



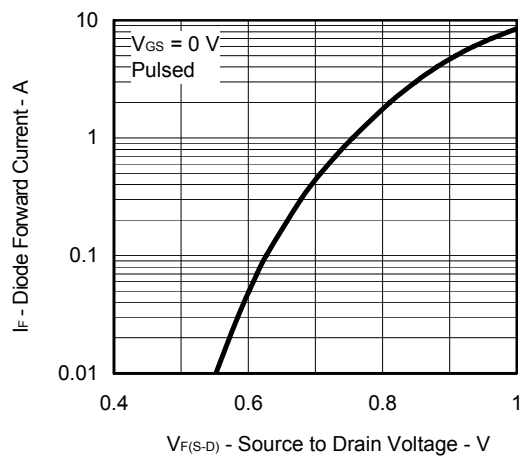
SWITCHING CHARACTERISTICS



DYNAMIC INPUT CHARACTERISTICS

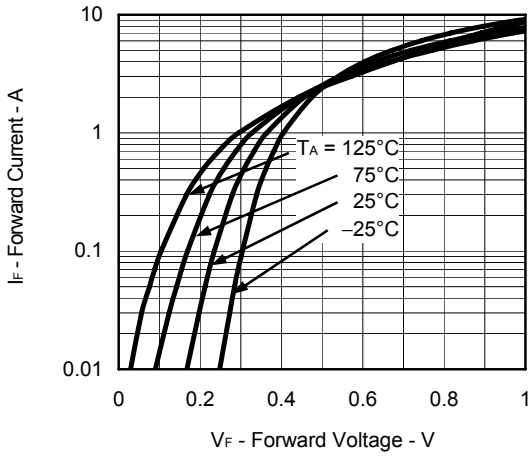


SOURCE TO DRAIN DIODE FORWARD VOLTAGE

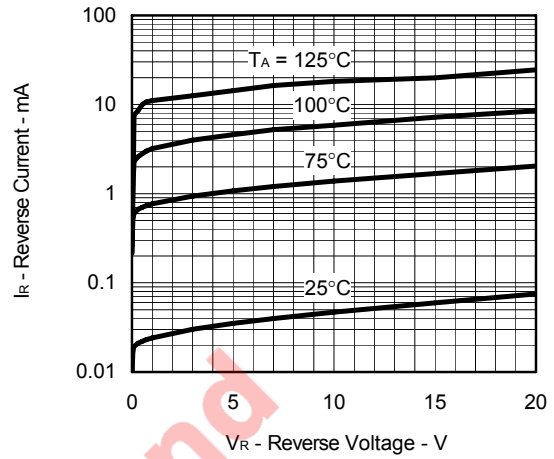


SCHOTTKY BARRIER DIODE TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise specified)

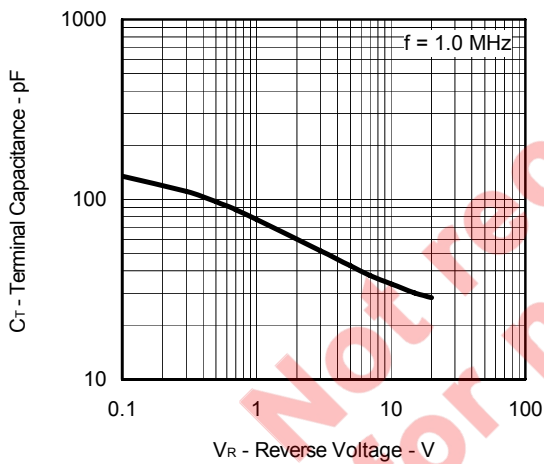
FORWARD CURRENT vs. FORWARD VOLTAGE



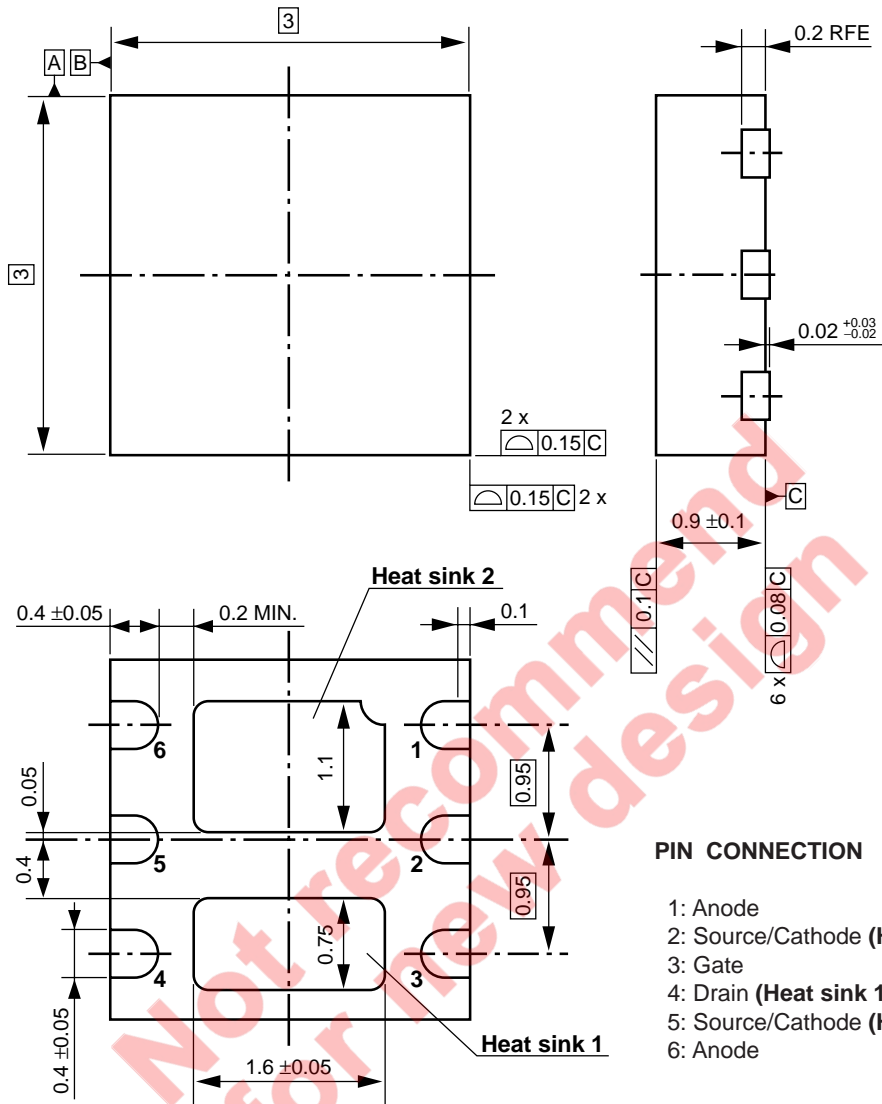
<R> REVERSE CURRENT vs. REVERSE VOLTAGE



TERMINAL CAPACITANCE vs. REVERSE VOLTAGE



PACKAGE DRAWING (Unit: mm)



PIN CONNECTION

- 1: Anode
- 2: Source/Cathode (**Heat sink 2**)
- 3: Gate
- 4: Drain (**Heat sink 1**)
- 5: Source/Cathode (**Heat sink 2**)
- 6: Anode

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