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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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**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
 $V_F = 0.36 \text{ V TYP. (} I_F = 1.0 \text{ A)}$

ORDERING INFORMATION

PART NUMBER	PACKAGE
μPA2680T1E	6LD3x3MLP

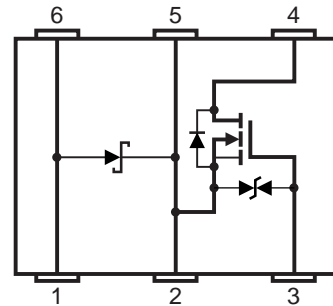
Marking: **A2680**

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.

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

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

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

MOSFET

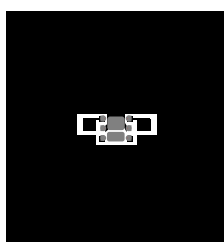
Drain to Source Voltage (VGS = 0 V)	V _{DSS}	20	V
Gate to Source Voltage (VDS = 0 V)	V _{GSS}	±12	V
Drain Current (DC) ^{Note1}	I _{D(DC)}	±3.0	A
Drain Current (pulse) ^{Note2}	I _{D(pulse)}	±12.0	A
Total Power Dissipation ^{Note1}	P _T	1.3	W
Channel Temperature	T _{ch}	150	°C
Storage Temperature	T _{stg}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

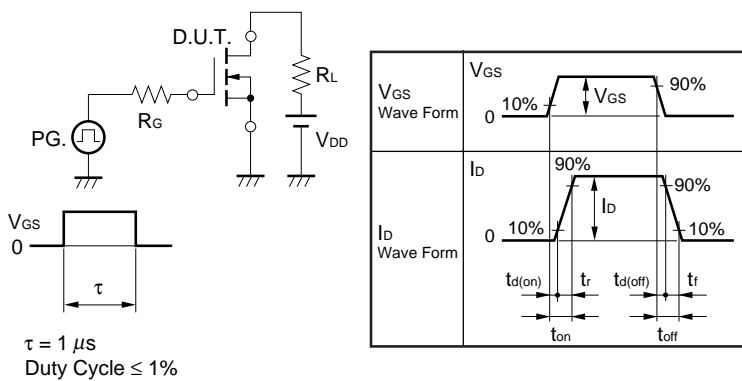
ELECTRICAL CHARACTERISTICS (TA = 25°C, unless otherwise specified)

MOSFET

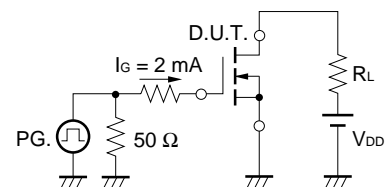
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 20 V, V _{GS} = 0 V			1	μA
Gate Leakage Current	I _{GSS}	V _{GS} = ±12 V, V _{DS} = 0 V			±10	μA
Gate to Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 0.25 mA	0.6		2.0	V
Forward 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



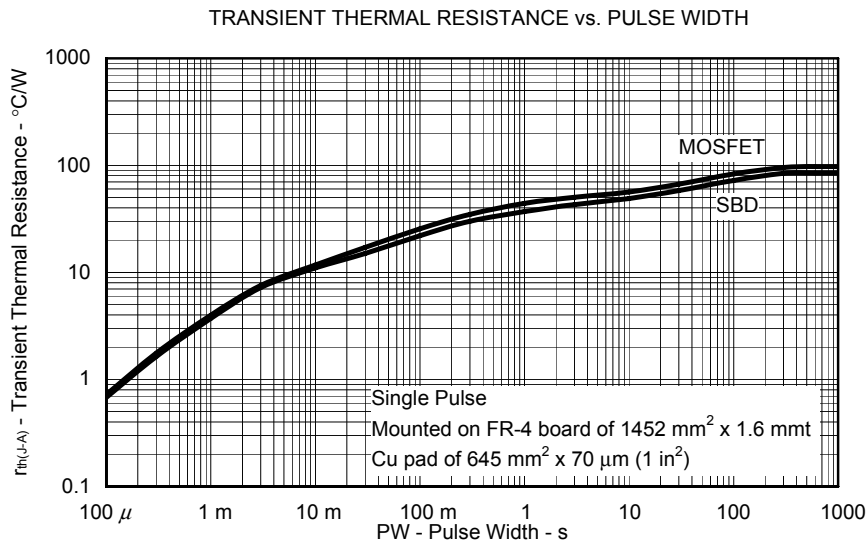
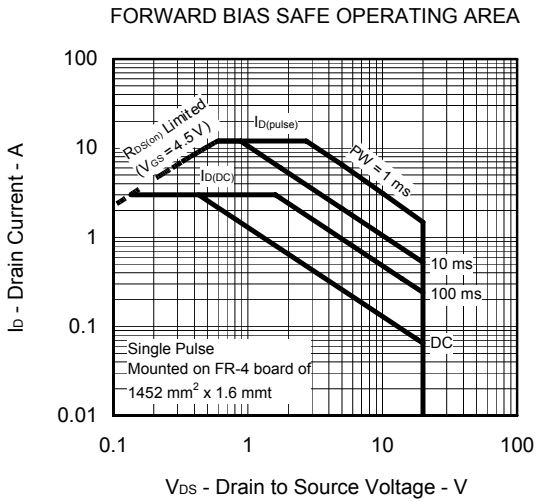
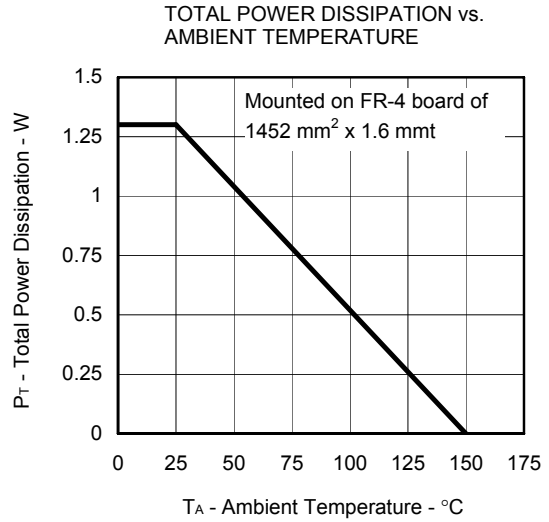
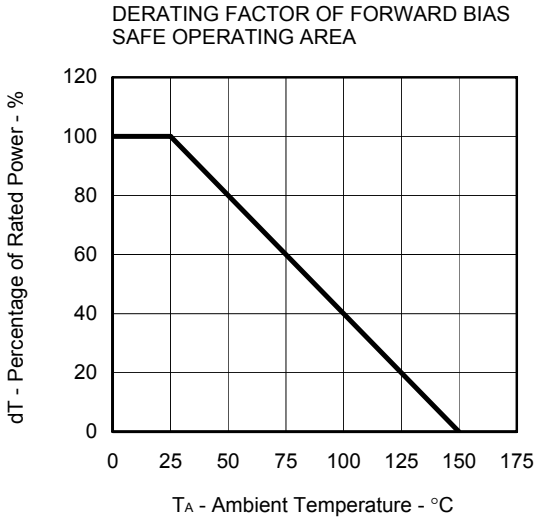
TEST CIRCUIT 2 GATE CHARGE



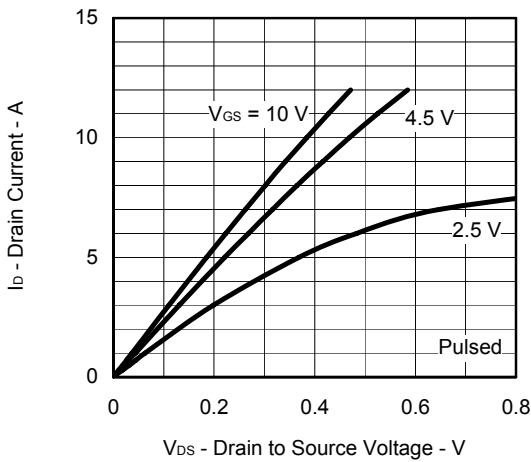
Schottky Barrier Diode

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

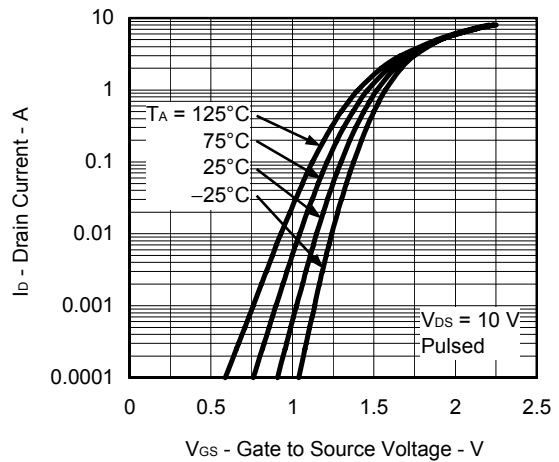
MOSFET TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise specified)



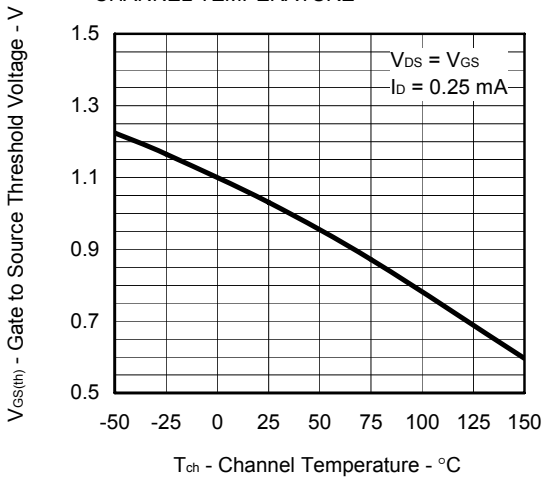
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



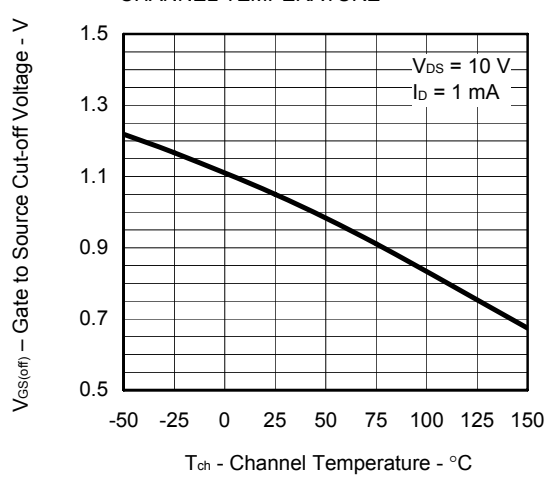
FORWARD TRANSFER CHARACTERISTICS



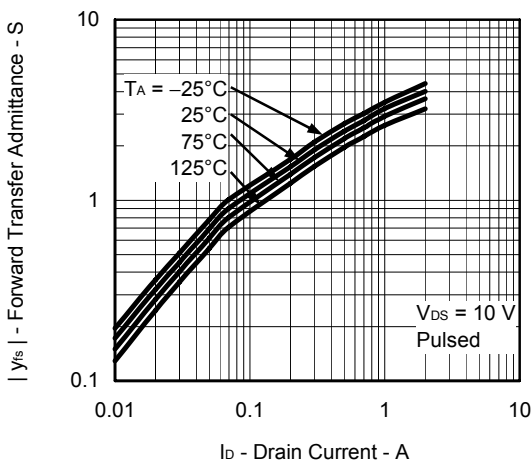
GATE TO SOURCE THRESHOLD VOLTAGE vs. CHANNEL TEMPERATURE



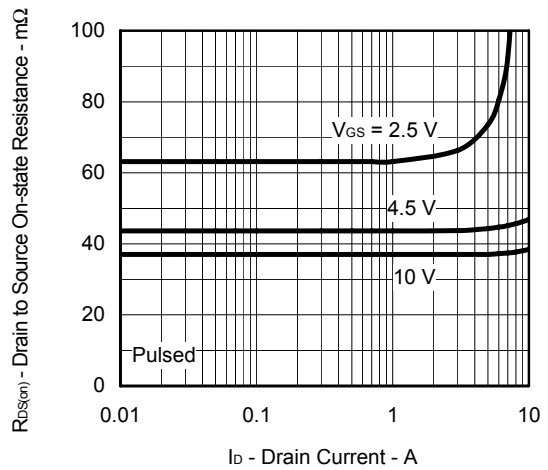
GATE TO SOURCE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



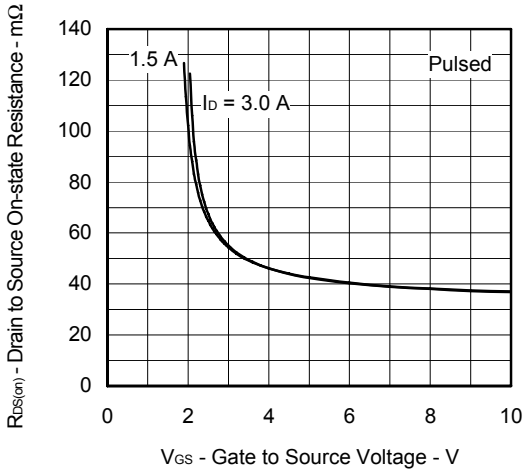
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



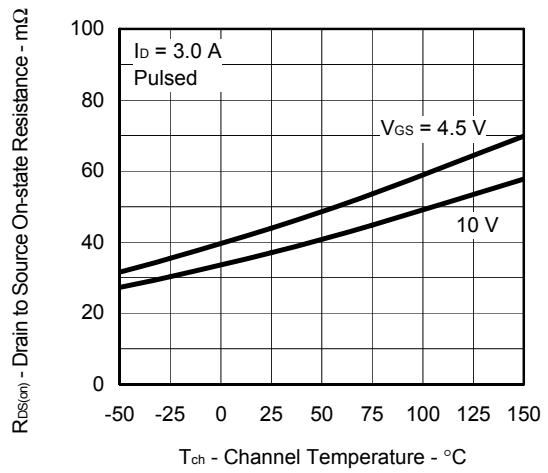
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



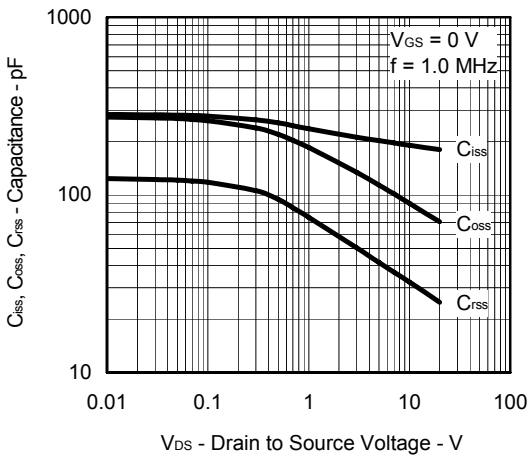
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



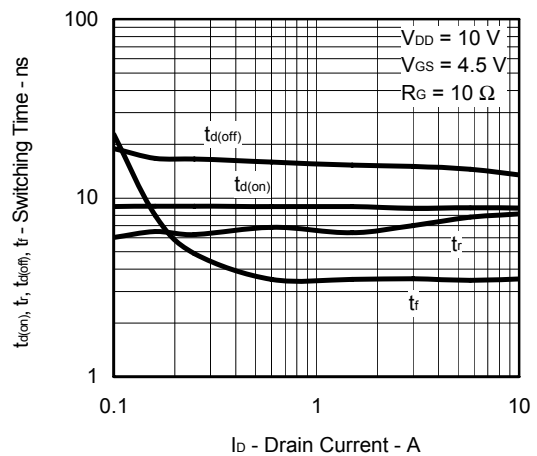
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



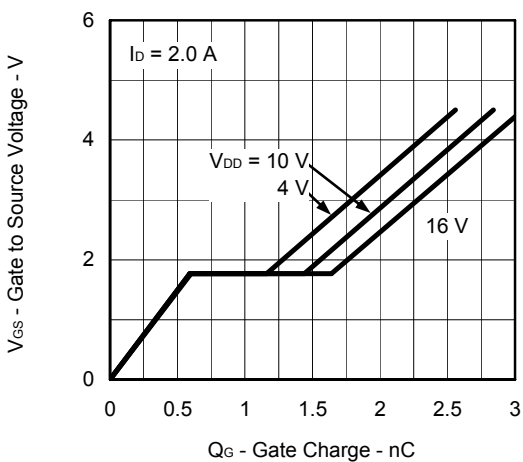
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



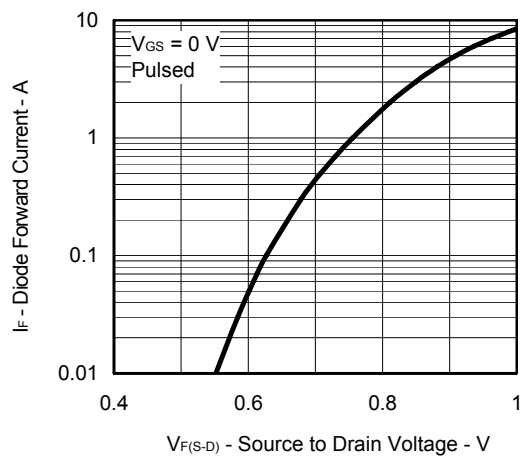
SWITCHING CHARACTERISTICS



DYNAMIC INPUT CHARACTERISTICS

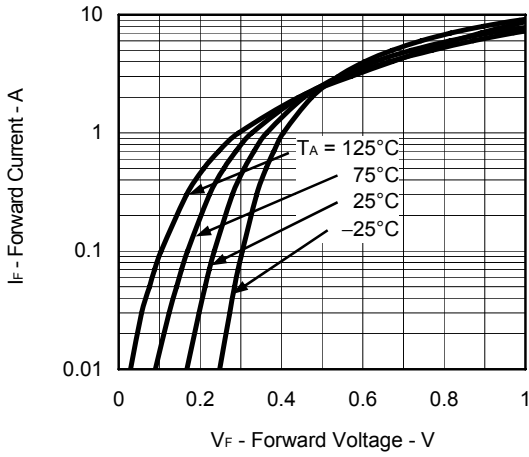


SOURCE TO DRAIN DIODE FORWARD VOLTAGE

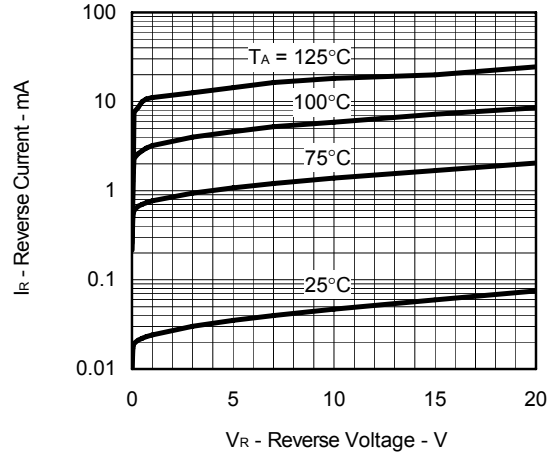


SCHOTTKY BARRIER DIODE TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise specified)

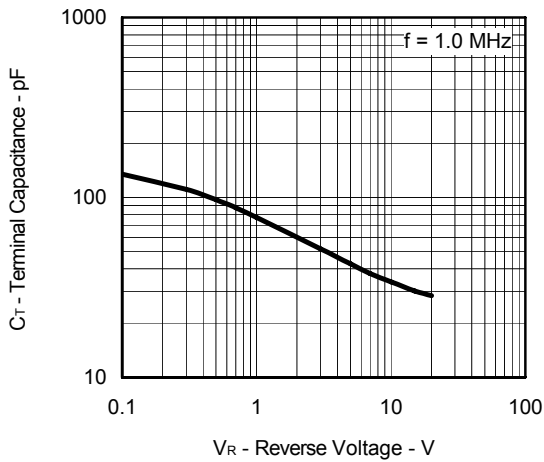
FORWARD CURRENT vs. FORWARD VOLTAGE



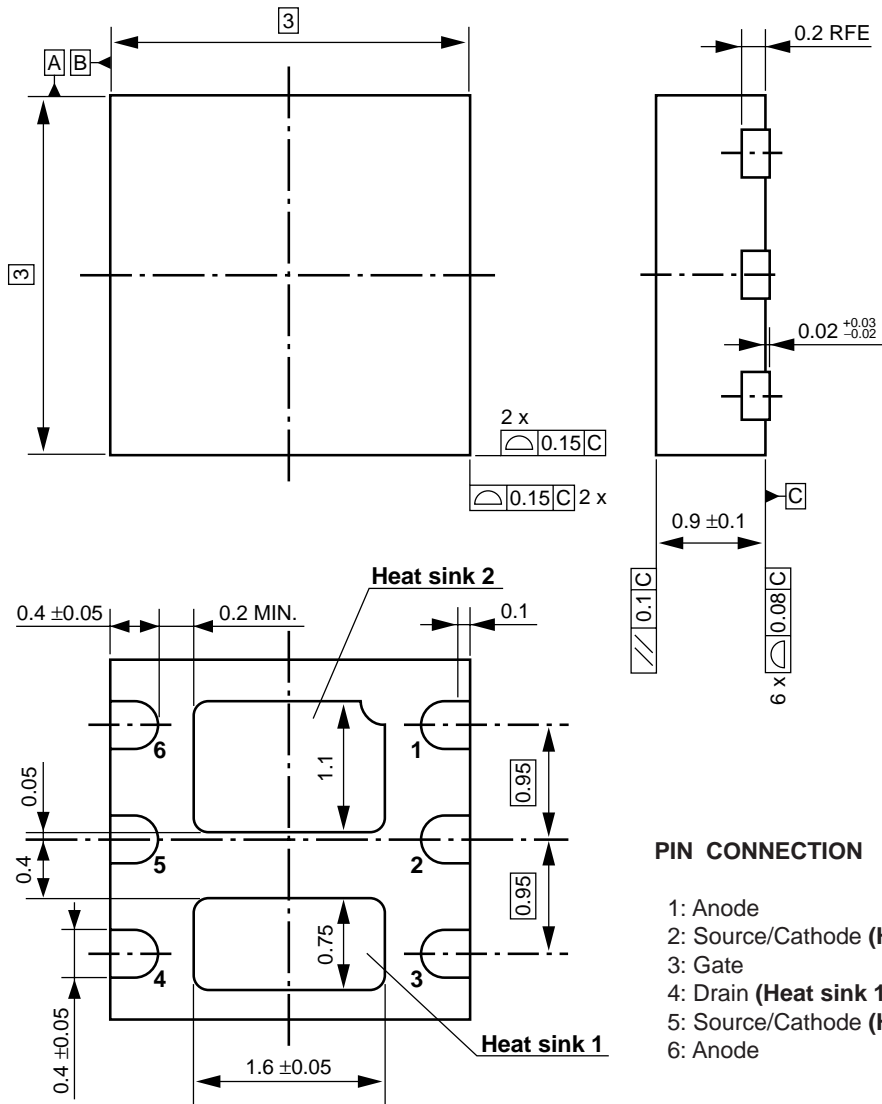
<R> REVERSE CURRENT vs. REVERSE VOLTAGE



TERMINAL CAPACITANCE vs. REVERSE VOLTAGE



PACKAGE DRAWING (Unit: mm)



PIN CONNECTION

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- 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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