DATA SHEET

NEC

MOSFET WITH SCHOTTKY BARRIER DIODE

μPA2680T1E

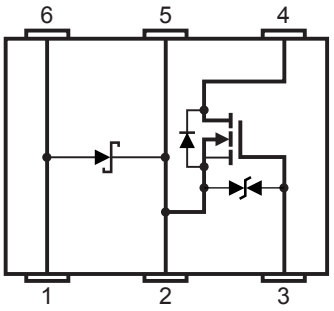
N-CHANNEL MOSFET WITH SCHOTTKY BARRIER DIODE FOR SWITCHING

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.

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

FEATURES

- 4.5 V drive available MOSFET
- Low on-state resistance MOSFET
  $R_{DS(on)1}$ = 38 mΩ TYP. (V_{GS} = 10 V, I_D = 3.0 A)
  $R_{DS(on)2}$ = 44 mΩ TYP. (V_{GS} = 4.5 V, I_D = 3.0 A)
- Low forward voltage Schottky Barrier Diode
  V_F = 0.36 V TYP. (I_F = 1.0 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} = ±150 V TYP. (C = 200 pF, R = 0 Ω, Single Pulse)

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The mark <R> shows major revised points.
The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.

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

MOSFET

Drain to Source Voltage (V_{GS} = 0 V)	V_{DSS}	20	V
Gate to Source Voltage (V_{DS} = 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

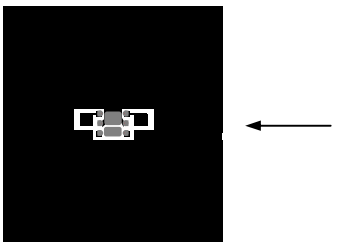
Notes 1. Mounted on a 1 in^2 pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick FR-4 board
(Cu pad: 322 mm^2 x 70 μm, FR-4: 1452 mm^2 x 1.6 mmt)

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 in^2 pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick FR-4 board
(Cu pad: 322 mm^2 x 70 μm, FR-4: 1452 mm^2 x 1.6 mmt)



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

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

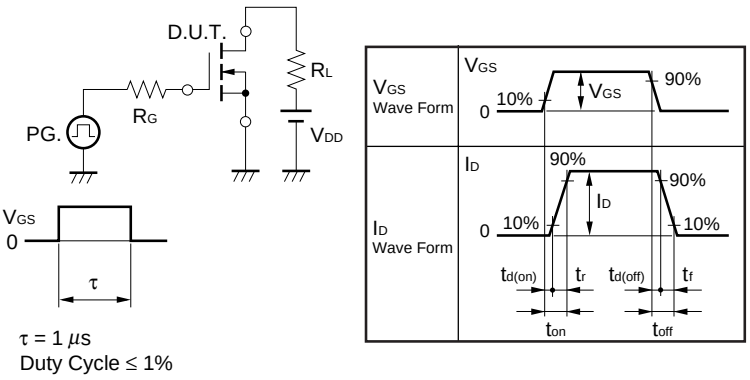
ELECTRICAL CHARACTERISTICS (T_A = 25°C, unless otherwise specified)

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

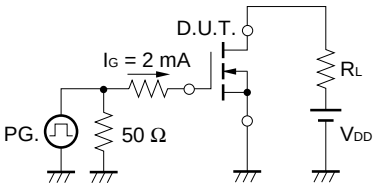
Note Pulsed: PW ≤ 350 μs, Duty Cycle ≤ 2%

TEST CIRCUIT 1 SWITCHING TIME



τ = 1 μs
Duty Cycle ≤ 1%

TEST CIRCUIT 2 GATE CHARGE

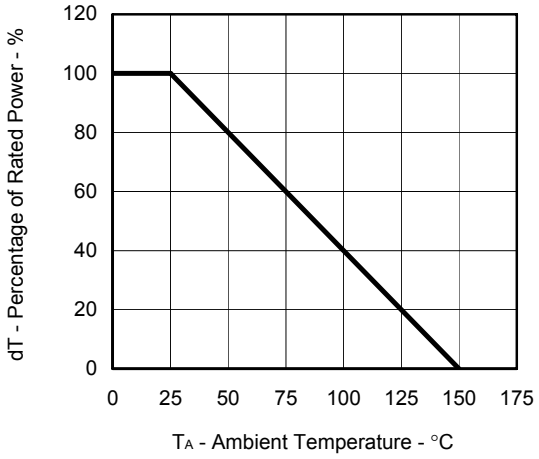


Schottky Barrier Diode

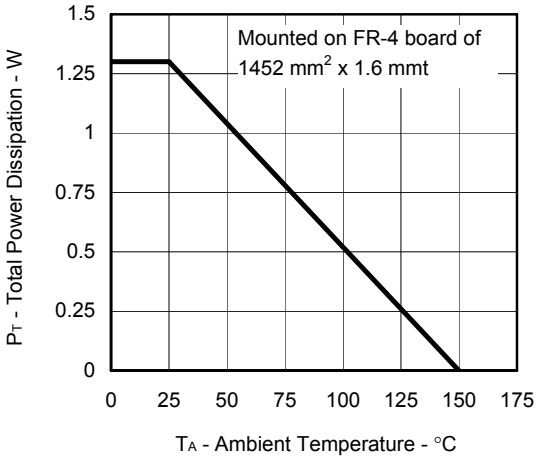
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Forward Voltage	V_F	I_F = 1.0 A		0.36	0.39	V
Reverse Current	I_R	V_R = 5 V, T_A = 100°C			15	mA
Terminal Capacitance	C_T	f = 1.0 MHz, V_R = 10 V		36		pF

MOSFET TYPICAL CHARACTERISTICS (T_A = 25°C, unless otherwise specified)

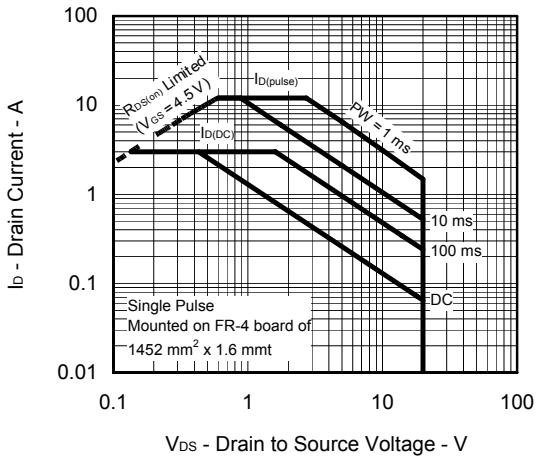
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



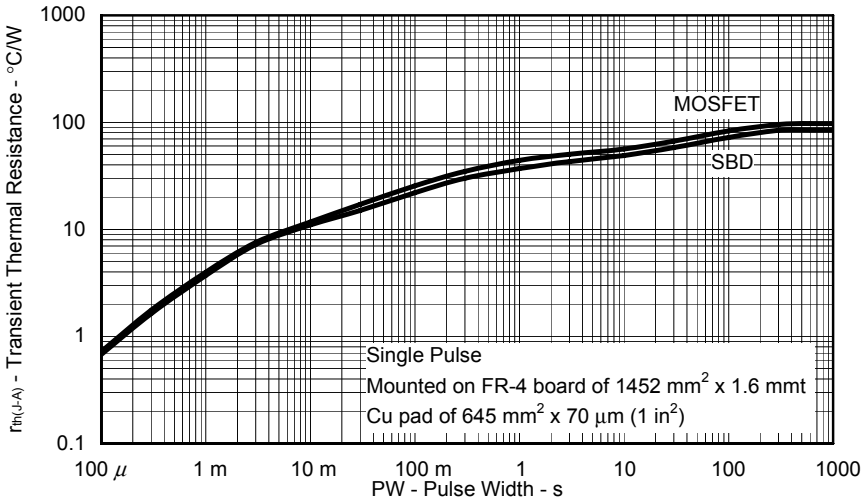
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



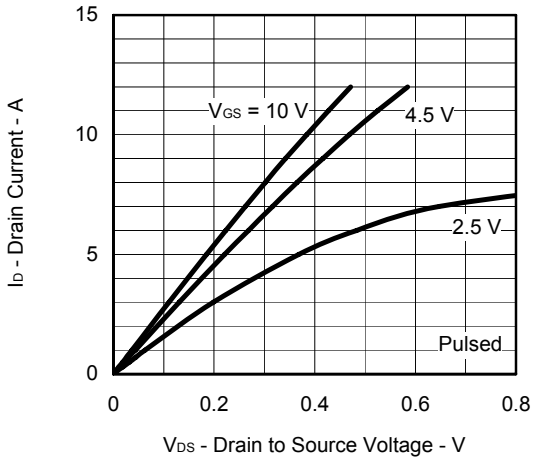
FORWARD BIAS SAFE OPERATING AREA



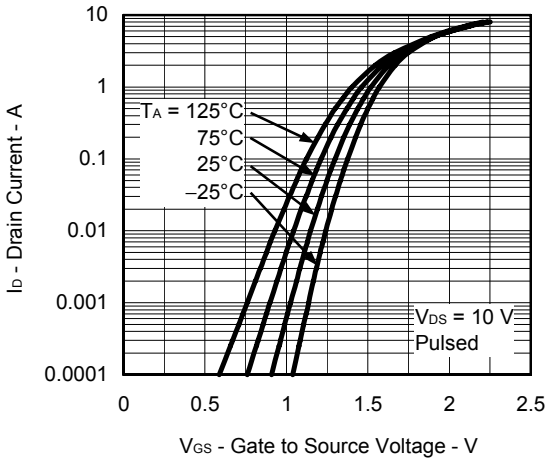
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



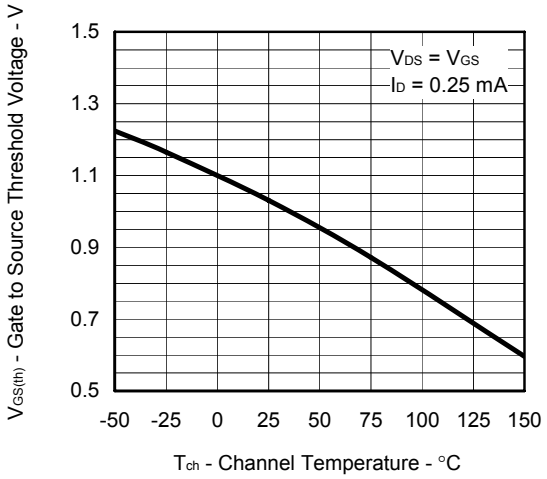
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



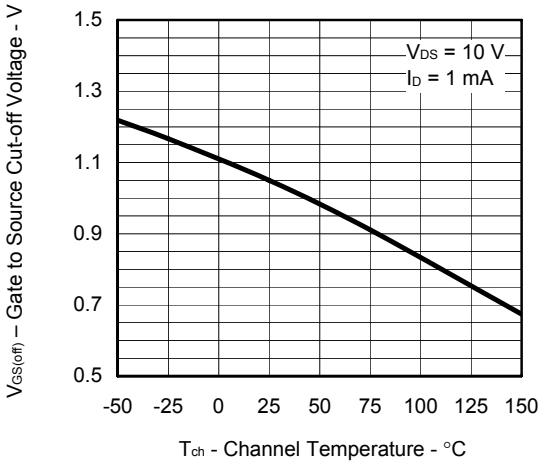
FORWARD TRANSFER CHARACTERISTICS



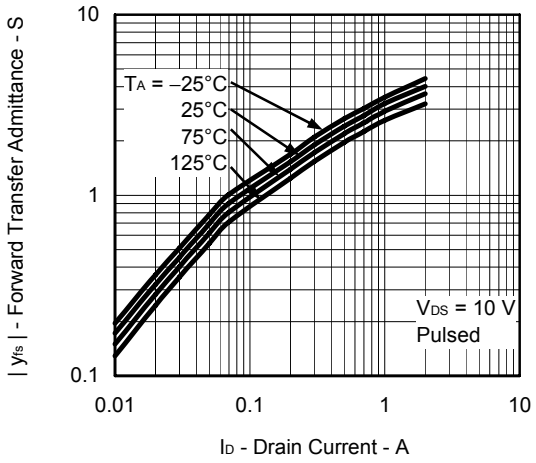
GATE TO SOURCE THRESHOLD VOLTAGE vs.
CHANNEL TEMPERATURE



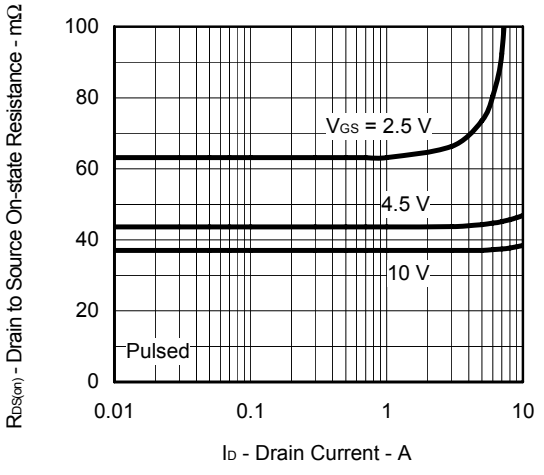
GATE TO SOURCE CUT-OFF VOLTAGE vs.
CHANNEL TEMPERATURE



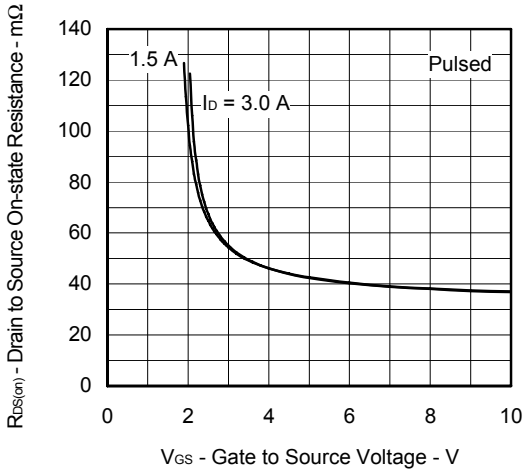
FORWARD TRANSFER ADMITTANCE vs.
DRAIN CURRENT



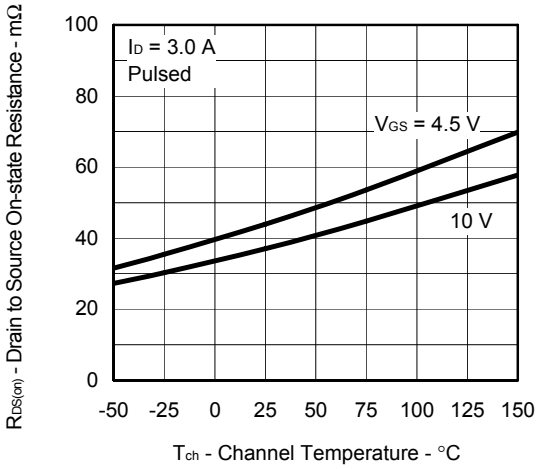
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
DRAIN CURRENT



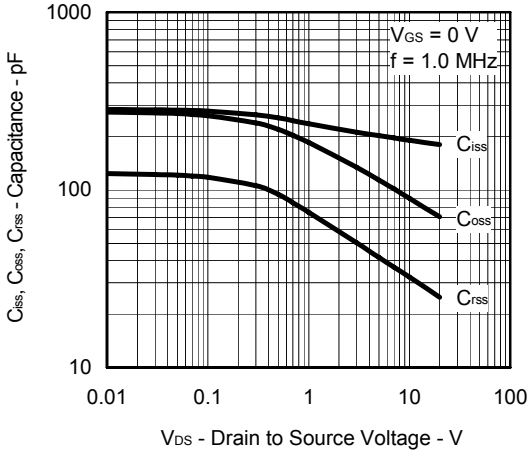
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



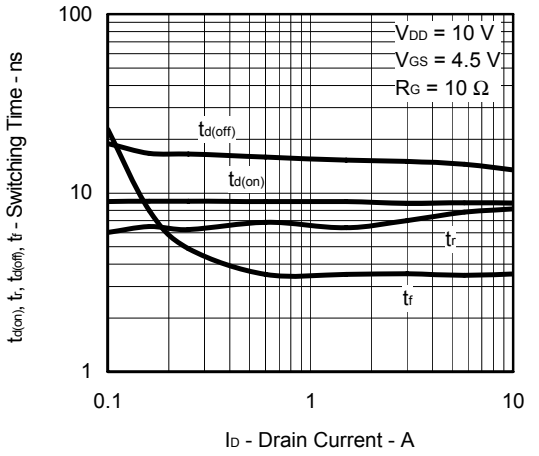
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



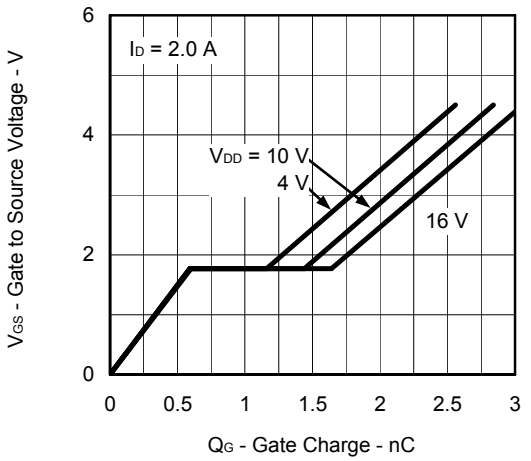
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



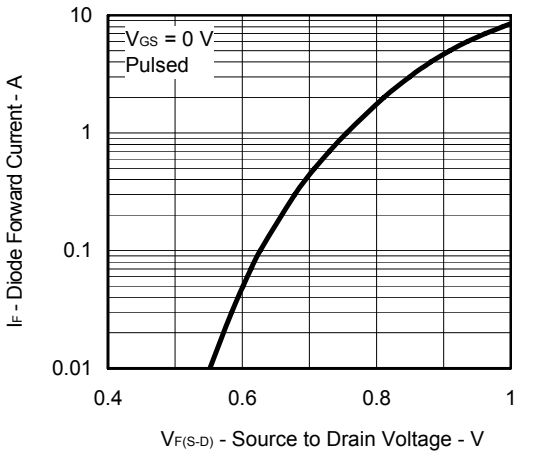
SWITCHING CHARACTERISTICS



DYNAMIC INPUT CHARACTERISTICS

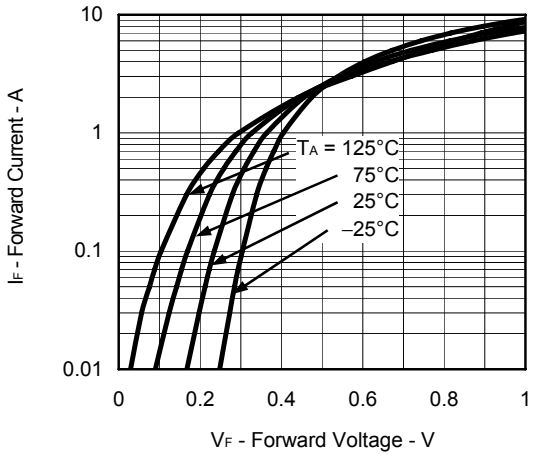


SOURCE TO DRAIN DIODE FORWARD VOLTAGE

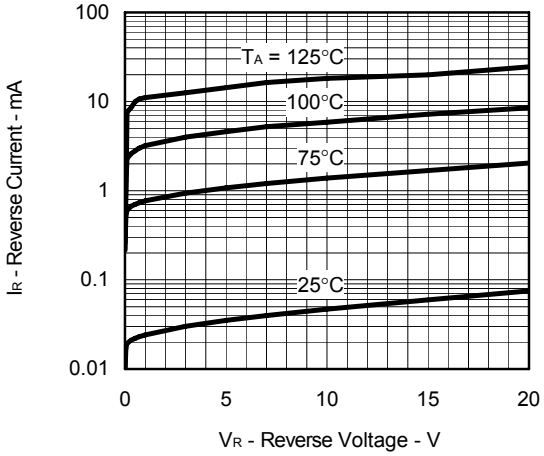


SCHOTTKY BARRIER DIODE TYPICAL CHARACTERISTICS (T_A = 25°C, unless otherwise specified)

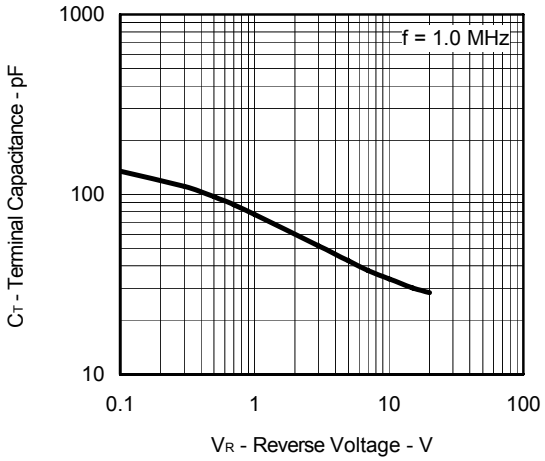
FORWARD CURRENT vs. FORWARD VOLTAGE



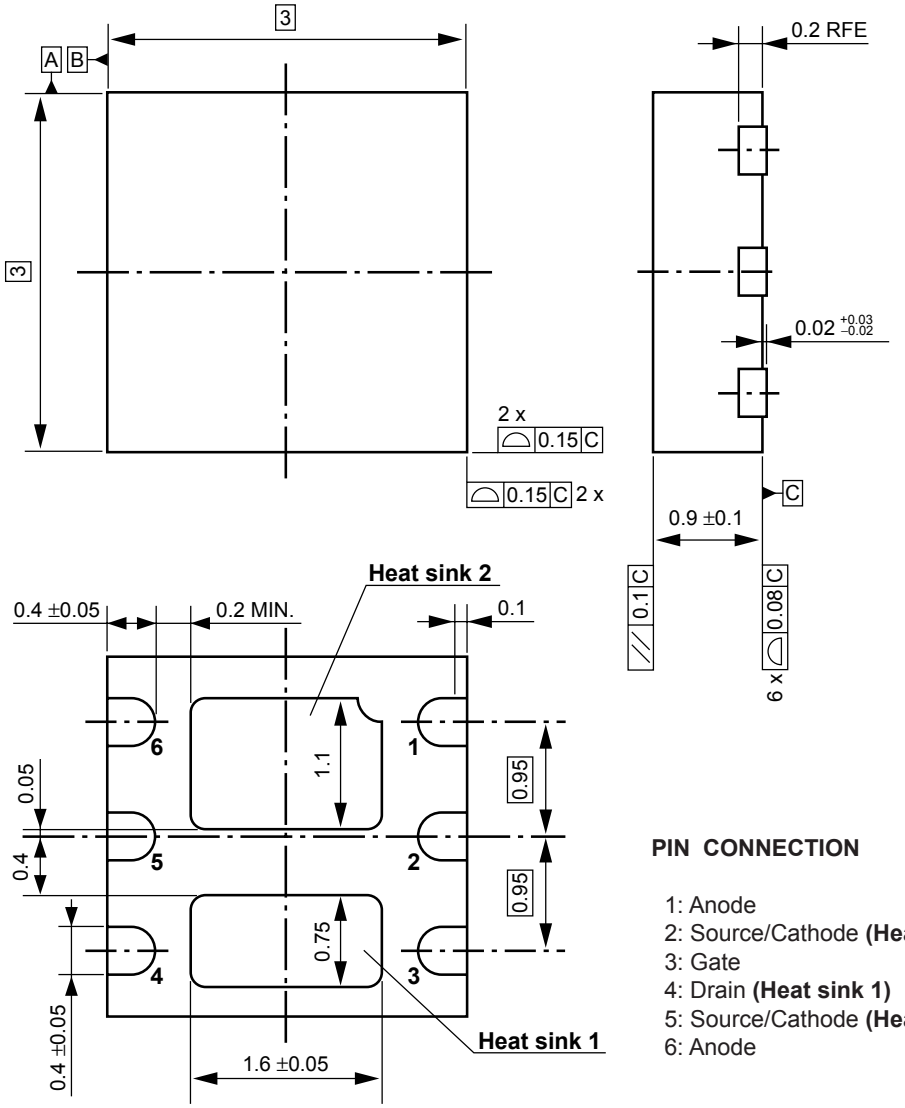
<R> REVERSE CURRENT vs. REVERSE VOLTAGE



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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