NEC

MOS FET WITH SCHOTTKY BARRIER DIODE
μPA508TE

N-CHANNEL MOS FET WITH SCHOTTKY BARRIER DIODE FOR SWITCHING

DESCRIPTION

The μPA508TE is a switching device, which can be driven directly by a 2.5 V power source.

This device incorporates a MOS FET, 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

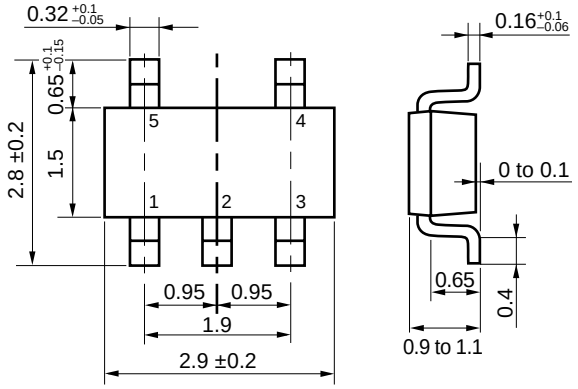
- 2.5 V drive available (MOS FET)
- Low on-state resistance (MOS FET)
  $R_{DS(on)1}$ = 40 mΩ TYP. (V_{GS} = 4.5 V, I_D = 1.0 A)
  $R_{DS(on)2}$ = 42 mΩ TYP. (V_{GS} = 4.0 V, I_D = 1.0 A)
  $R_{DS(on)3}$ = 59 mΩ TYP. (V_{GS} = 2.5 V, I_D = 1.0 A)
- Low forward voltage (Schottky barrier diode)
  V_F = 0.35 V TYP. (I_F = 1.0 A)

ORDERING INFORMATION

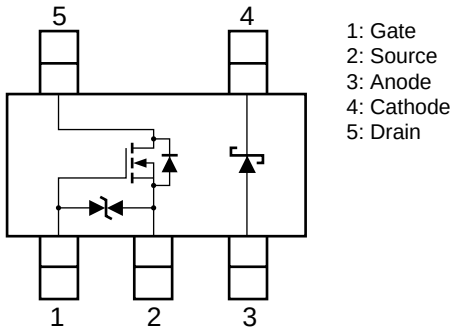
PART NUMBER	PACKAGE
μPA508TE	SC-95_5p (Mini Mold Thin Type)

Marking: ZB

PACKAGE DRAWING (Unit: mm)



★ PIN CONNECTION (Top View)



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)

Document No. G16627EJ1V1DS00 (1st edition)
Date Published December 2003 NS CP(K)
Printed in Japan

The mark ★ shows major revised points.

MOS FET ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

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)	$I_{D(DC)}$	±2	A
Drain Current (pulse) **Note1**	$I_{D(pulse)}$	±8	A
Total Power Dissipation **Note2**	P_T	0.57	W
Channel Temperature	T_{ch}	150	°C

Notes 1. PW ≤ 10 μs, Duty Cycle ≤ 1%

2. Mounted on FR-4 board of 2500 mm^2 x 1.6 mm, t ≤ 5 sec.

SCHOTTKY BARRIER DIODE ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

Repetitive Peak Reverse Voltage	V_{RRM}	30	V
Average Forward Current **Note1**	$I_{F(AV)}$	1	A
Surge Current **Note2**	I_{FSM}	10	A
Junction Temperature	T_j	+125	°C
Storage Temperature	T_{stg}	−55 to +125	°C

Notes 1. Mounted on FR-4 board of 2500 mm^2 x 1.6 mm, t ≤ 5 sec

2. 50 Hz sine wave, 1 cycle

MOS FET ELECTRICAL CHARACTERISTICS (T_A = 25°C)

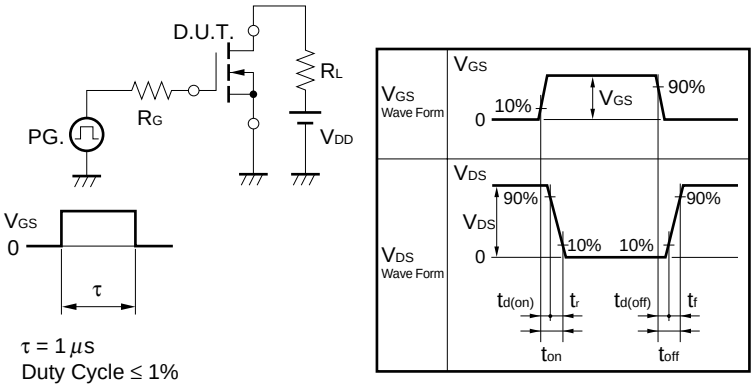
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 20 V, V_{GS} = 0 V			1	μA
Gate Leakage Current	I_{GSS}	V_{GS} = ±12 V, V_{DS} = 0 V			±10	μA
Gate Cut-off Voltage Note	$V_{GS(off)}$	V_{DS} = 10 V, I_D = 1.0 mA	0.5	1.0	1.5	V
Forward Transfer Admittance Note	$\|y_{fs}\|$	V_{DS} = 10 V, I_D = 1.0 A	1.0	3.3		S
Drain to Source On-state Resistance Note	$R_{DS(on)1}$	V_{GS} = 4.5 V, I_D = 1.0 A		40	51	mΩ
	$R_{DS(on)2}$	V_{GS} = 4.0 V, I_D = 1.0 A		42	57	mΩ
	$R_{DS(on)3}$	V_{GS} = 2.5 V, I_D = 1.0 A		59	90	mΩ
Input Capacitance	C_{iss}	V_{DS} = 10 V		170		pF
Output Capacitance	C_{oss}	V_{GS} = 0 V		80		pF
Reverse Transfer Capacitance	C_{rss}	f = 1.0 MHz		40		pF
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 10 V, I_D = 1.0 A		9		ns
Rise Time	t_r	V_{GS} = 4.0 V		9		ns
Turn-off Delay Time	$t_{d(off)}$	R_G = 10 Ω		15		ns
Fall Time	t_f			4		ns
Total Gate Charge	Q_G	V_{DD} = 16 V		2.7		nC
Gate to Source Charge	Q_{GS}	V_{GS} = 4.0 V		0.6		nC
Gate to Drain Charge	Q_{GD}	I_D = 2.0 A		1.0		nC
Body Diode Forward Voltage	$V_{F(S-D)}$	I_F = 2.0 A, V_{GS} = 0 V		0.81		V

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

SCHOTTKY BARRIER DIODE ELECTRICAL CHARACTERISTICS (T_A = 25°C)

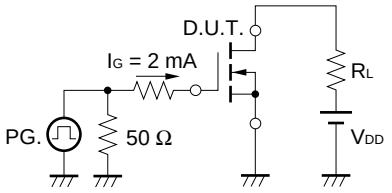
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Forward Voltage	V_F	I_F = 1.0 A		0.35	0.38	V
Reverse Current	I_R	V_R = 10 V			200	μA
Terminal Capacitance	C_T	f = 1.0 MHz, V_R = 10 V		36		pF

TEST CIRCUIT 1 SWITCHING TIME



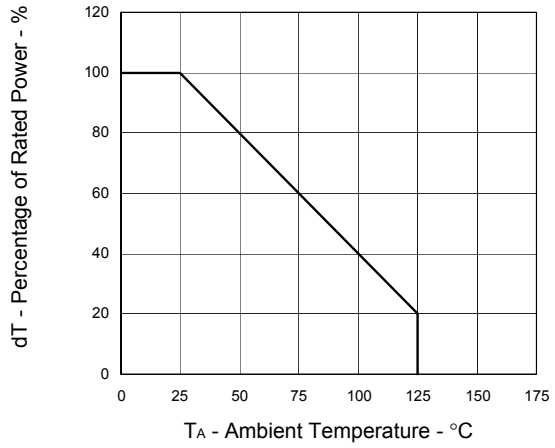
τ = 1 μs
Duty Cycle ≤ 1%

TEST CIRCUIT 2 GATE CHARGE

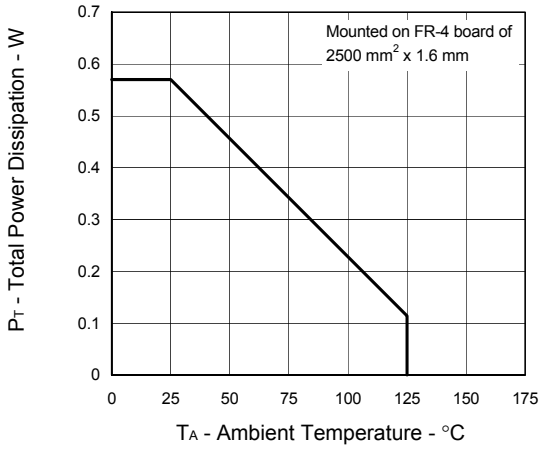


MOS FET TYPICAL CHARACTERISTICS (T_A = 25°C)

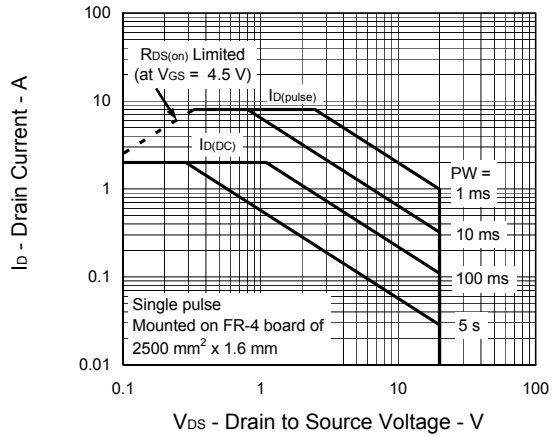
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



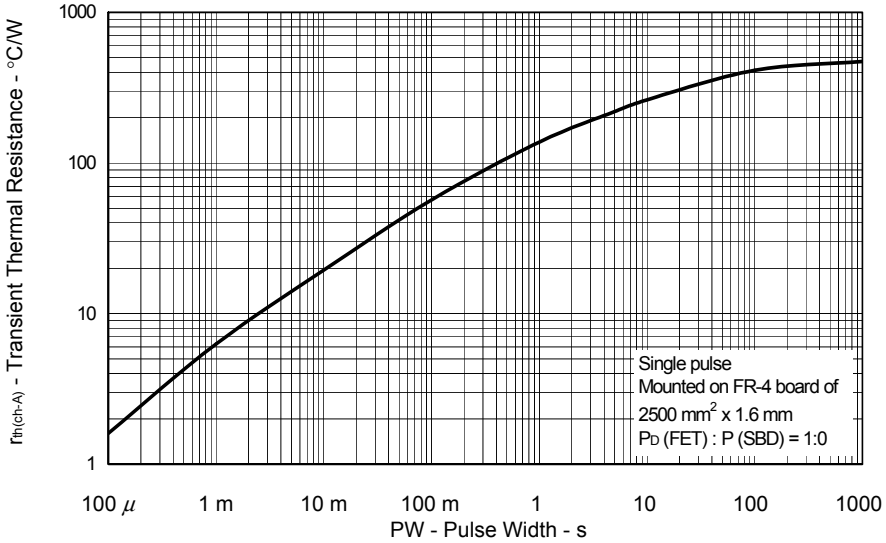
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



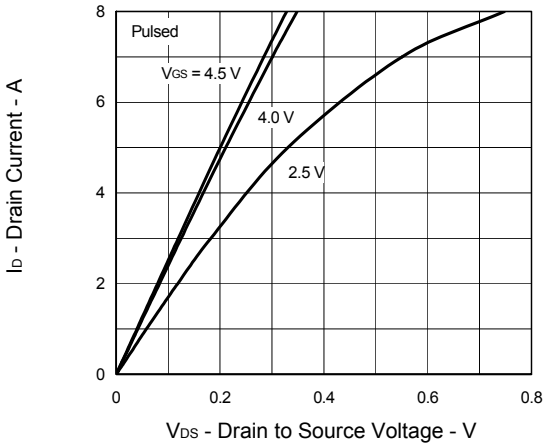
FORWARD BIAS SAFE OPERATING AREA



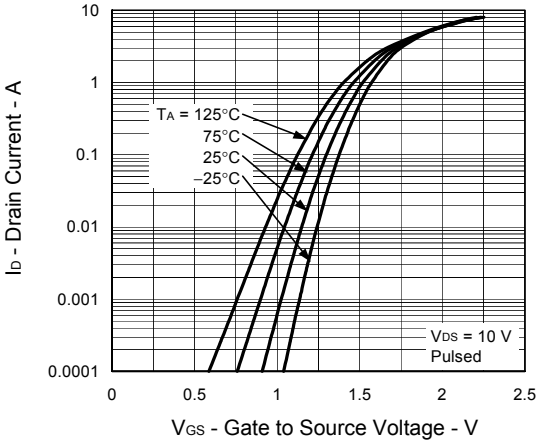
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



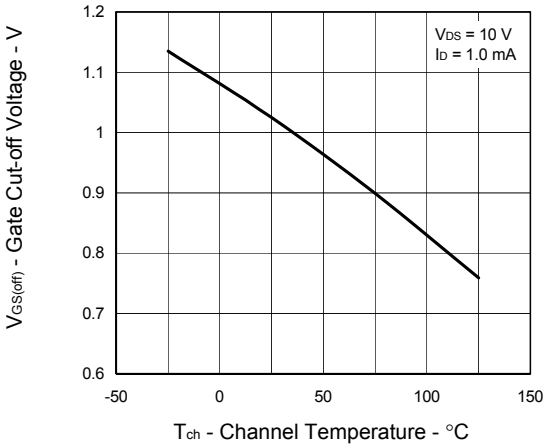
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



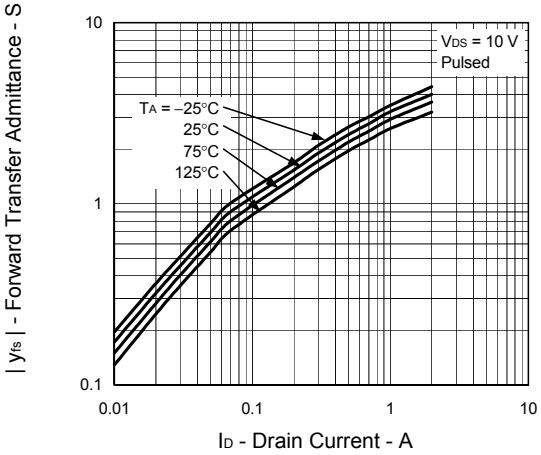
FORWARD TRANSFER CHARACTERISTICS



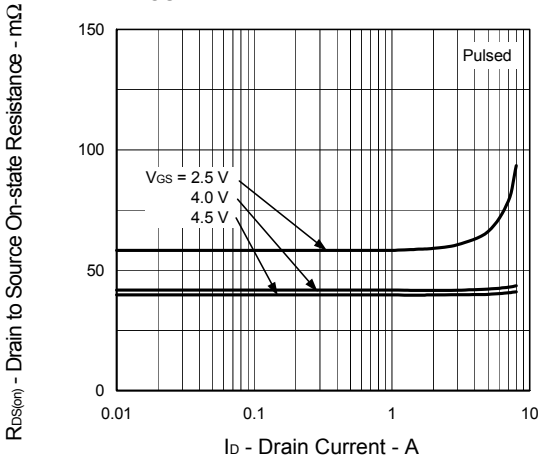
GATE CUT-OFF VOLTAGE vs.
CHANNEL TEMPERATURE



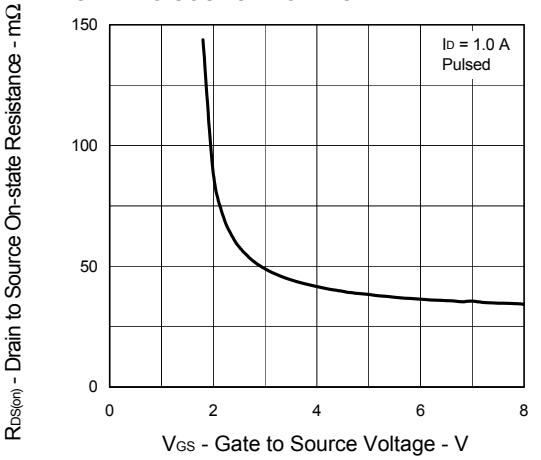
FORWARD TRANSFER ADMITTANCE vs.
DRAIN CURRENT



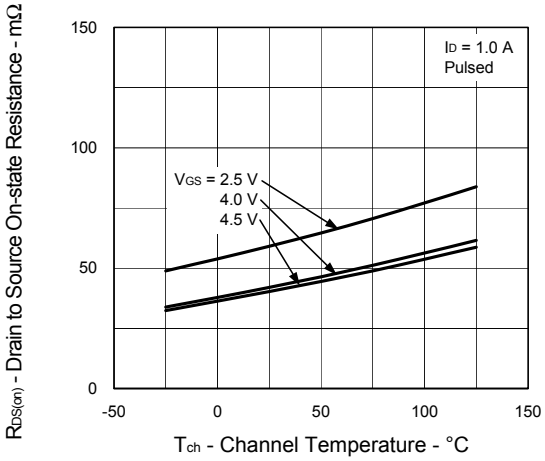
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
DRAIN CURRENT



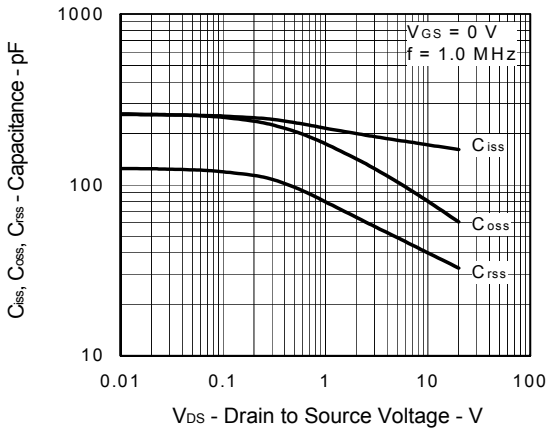
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
GATE TO SOURCE VOLTAGE



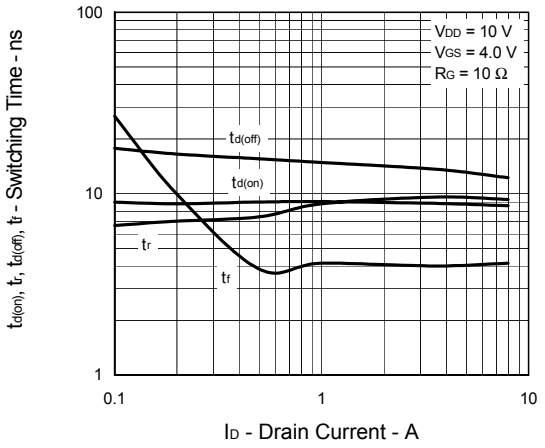
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



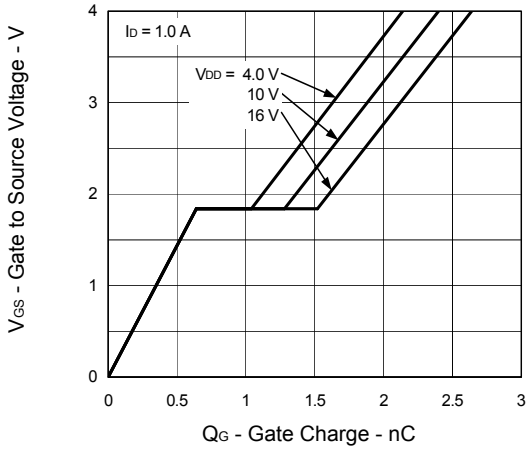
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



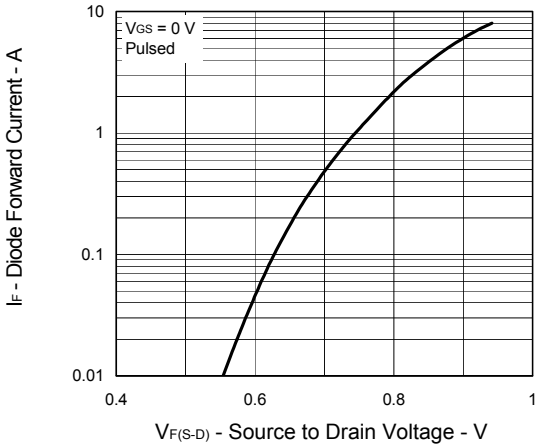
SWITCHING CHARACTERISTICS



DYNAMIC INPUT CHARACTERISTICS

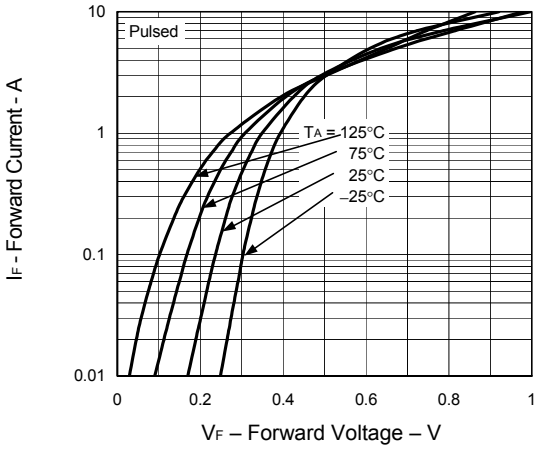


SOURCE TO DRAIN DIODE FORWARD VOLTAGE

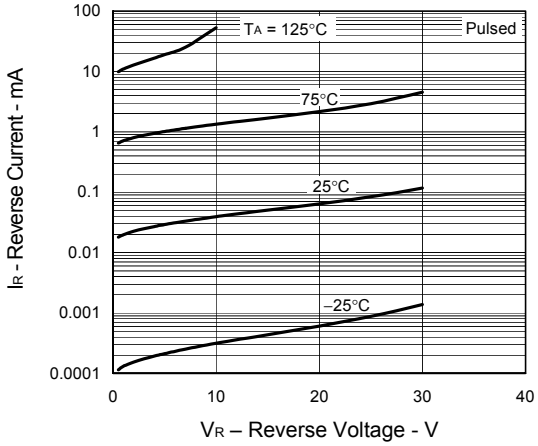


SCHOTTKY BARRIER DIODE TYPICAL CHARACTERISTICS (T_A = 25°C)

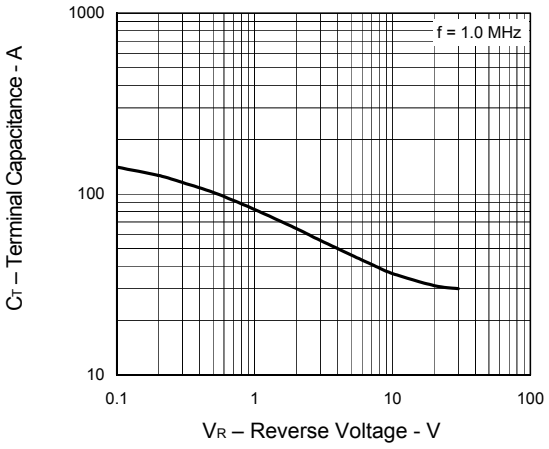
FORWARD CURRENT vs.
FORWARD VOLTAGE



REVERSE CURRENT vs.
REVERSE VOLTAGE



TERMINAL CAPACITANCE vs.
REVERSE VOLTAGE



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