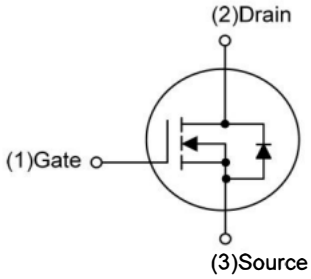
4A, 650V N-CHANNEL POWER MOSFET

DESCRIPTION

The 4N65 is a high voltage power MOSFET designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristic. This power MOSFET is usually used in high speed switching applications including power supplies, PWM motor controls, high efficient AC to DC converters and bridge circuits.



SYMBOL



■ FEATURES

*$R_{DS(ON)}$ ≤3Ω @ V_{GS}=10V, I_D=3A
* Fast Switching Capability
* Avalanche Energy Specified
* Improved dv/dt Capability, High Ruggedness

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

SYMBOL	PARAMETER		VALUE	UNIT
V_{DS}	Drain-Source Voltage		650	V
V_{GS}	Gate Source Voltage		±30	V
I_{AR}	Avalanche Current (Note 2)		4.4	A
I_D	Continuous Drain Current		4.0	A
I_{DM}	Pulsed Drain Current (Note 2)		16	A
E_{AS}	Avalanche Energy Single Pulsed (Note 3)		260	mJ
E_{AR}	Avalanche Energy Repetitive (Note2)		10.6	mJ
P_D	Power Dissipation (Note 1)	TO-220F	35	W
		TO-252	50	W
T_J	Junction Temperature		125	C
T_{STG}	Storage Temperature		-55 to 150	C
$R_{\theta JA}$	Thermal Resistance fromJunction to Ambient	TO-220F	62.5	°C/W
		TO-252	110	
$R_{\theta JC}$	Thermal Resistance From Junction To Case	TO-220F	3.5	'C/W
		TO-252	2.5	

Note: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. Repetitive Rating: Pulse width limited by maximum junction temperature.
3. L = 30mH, IAS = 4A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
4. I_{SD}≤4.4A, di/dt ≤200A/μs, V_{DD}≤BV_{DSS}, Starting T_J = 25°C

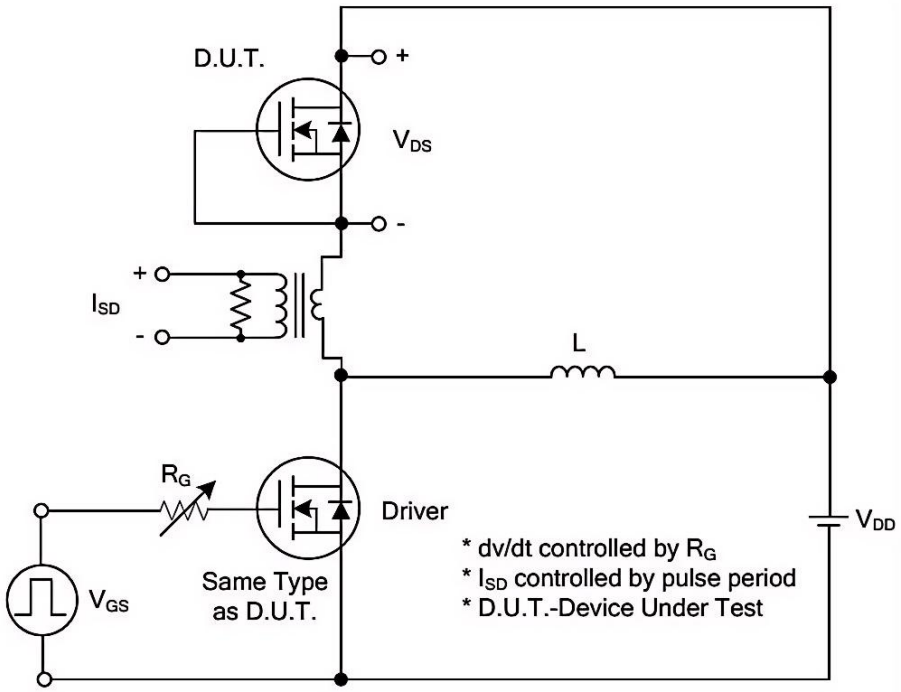
■ ELECTRICAL CHARACTERISTICS (TA=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS}=0V, I_D=250μA	650			V
Drain-Source Leakage Current	I_{DSS}	V_{DS}=650V, V_{GS}=0V			10	μA
		V_{DS}=480V, Tc=125°C			100	μA
Gate-Source Leakage Current	I_{GSS}	V_{GS} =±30V, V_{DS}=0V			±100	nA
Breakdown Voltage Temperature Coefficient	△BV_{DSS}/△T_J	I_D=250μA Referenced to 25°C		0.6		V/°C
ON CHARACTERISTICS						
Drain-source on-state resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=3A		2.7	3	Ω
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS}=V_{DS},I_D=250μA	2.0		4.0	V
DYNAMIC PARAMETERS						
Input Capacitance	C_{ISS}	V_{GS}=0V,V_{DS}=25V,f=1.0MHz		670	750	pF
Output Capacitance	C_{OSS}			70	90	
Reverse Transfer Capacitance	C_{RSS}			23	26	
SWITCHING PARAMETERS						
Total gate charge	Qg	V_{DS}=520V,V_{GS}=10V,I_D=4.0A (Note 1, 2)		100	120	nC
Gate-source charge	Qgs			17	19	
Gate-drain charge	Qgd			20	26	
Turn-On Delay Time	t_{D}(on)	V_{DD}=325V,R_G=25Ω,I_D=4.0A (Note 1, 2)		45	85	nS
Rise time	tr			100	140	
Turn-Off Delay Time	t_{D}(off)			200	240	
Fall time	tf			130	150	
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Continuous Drain-Source Current	I_S				4	A
Pulsed drain-source current	I_{SM}				17.6	A
Drain-Source Diode Forward Voltage	V_{SD}	V_{GS} = 0 V, I_S = 4.4A			1.4	V
Reverse Recovery Time	trr	dIF/dt = 100A/μs, I_S = 4.4A		250		ns
Reverse Recovery Charge	Qrr	V_{GS} = 0V (Note 1)		1.5		μC

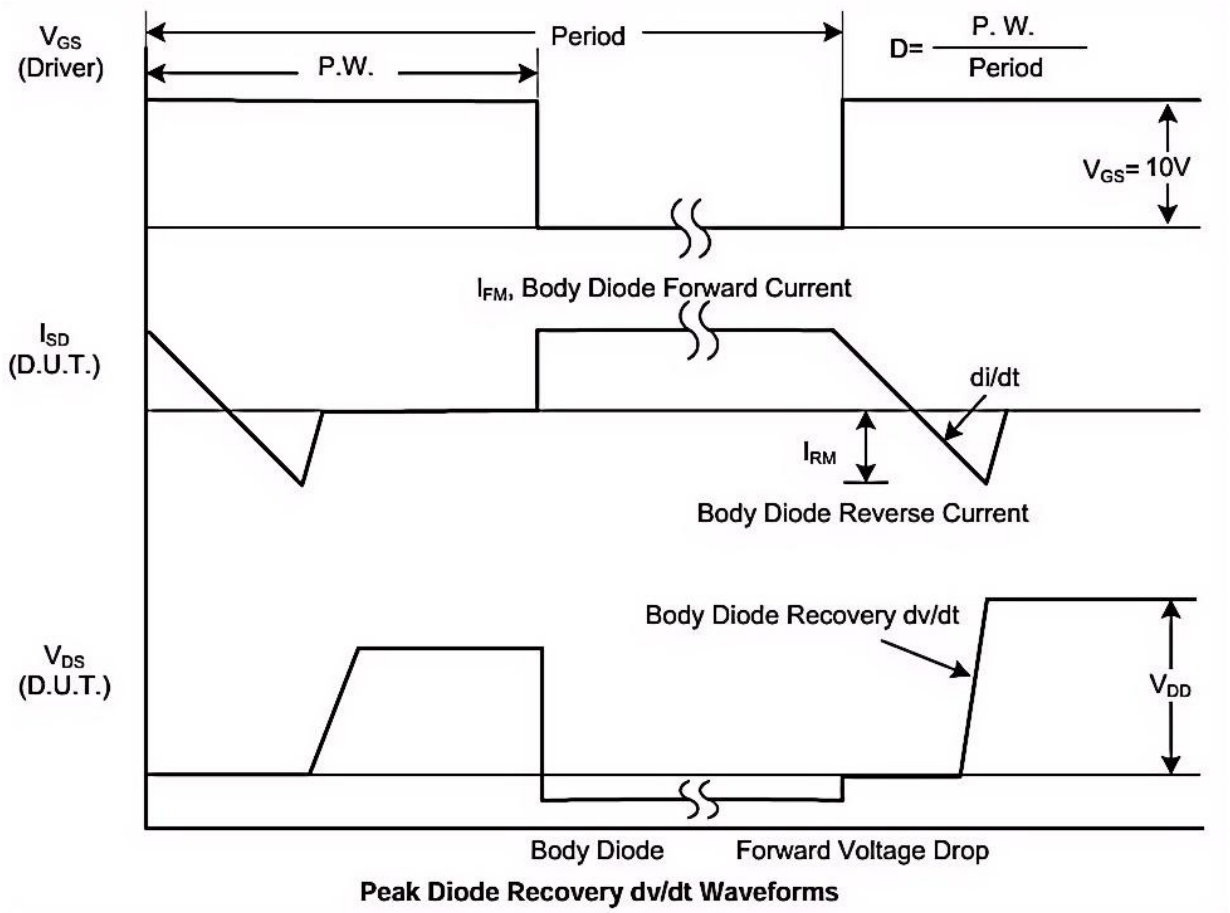
Notes:

1. Pulse Test : Pulse Width≤300μs, duty cycle ≤2%.
2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

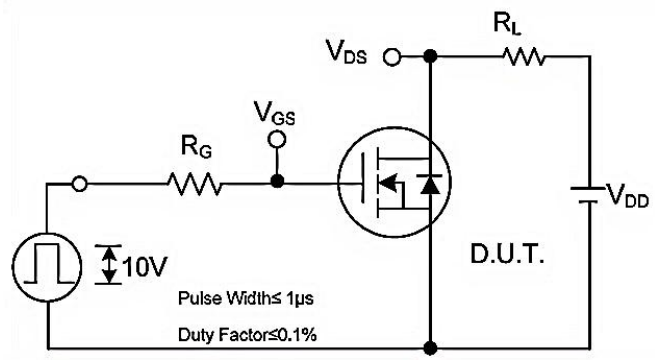


Peak Diode Recovery dv/dt Test Circuit

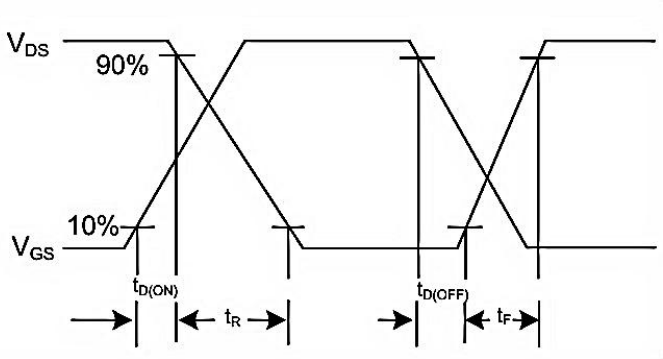


Peak Diode Recovery dv/dt Waveforms

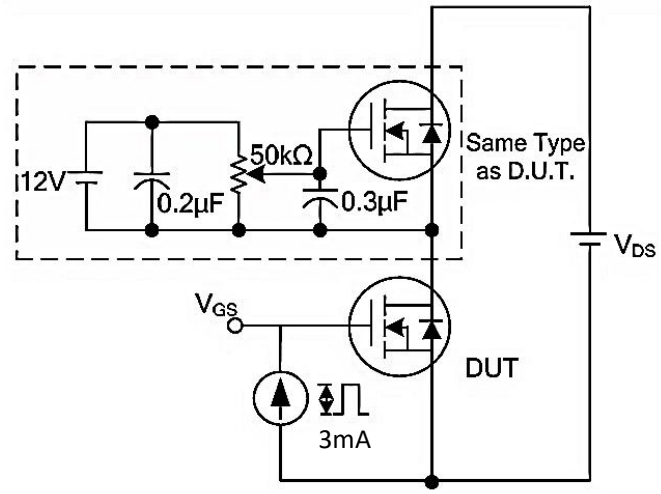
■ TEST CIRCUITS AND WAVEFORMS(Con.t)



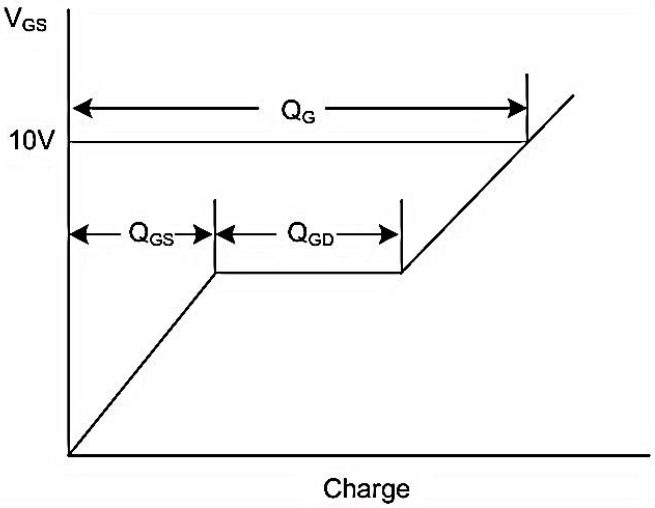
Switching Test Circuit



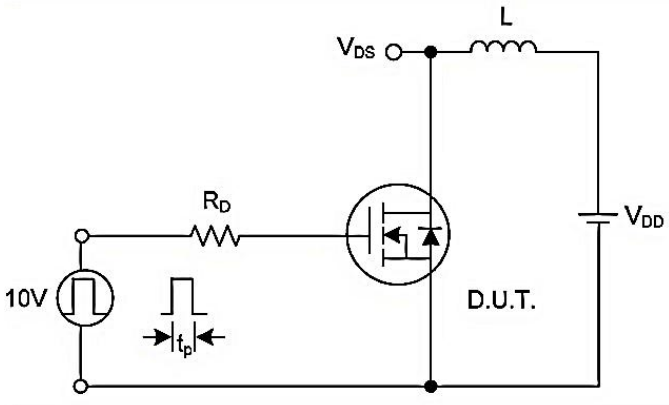
Switching Waveforms



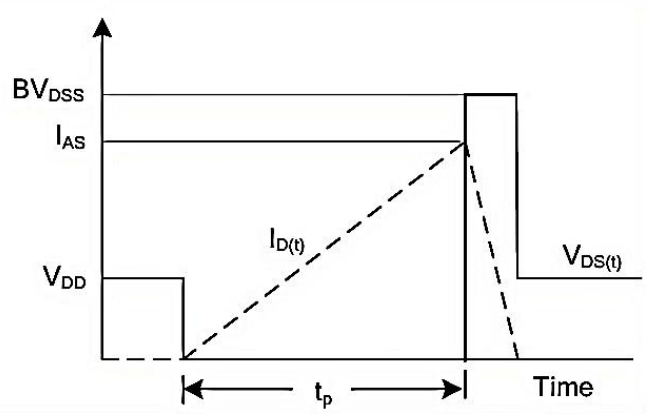
Gate Charge Test Circuit



Gate Charge Waveform



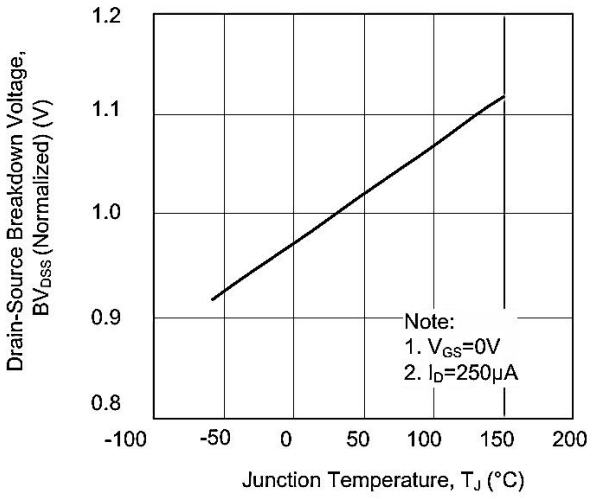
Unclamped Inductive Switching Test Circuit



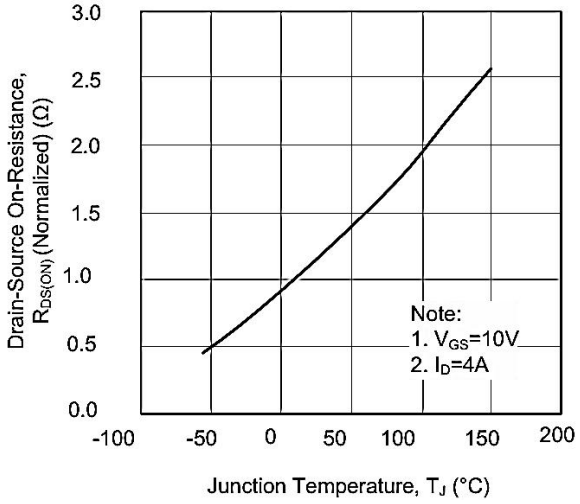
Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

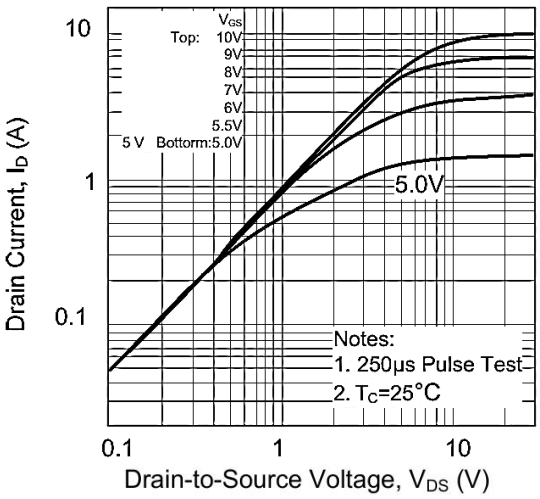
Breakdown Voltage Variation vs. Temperature



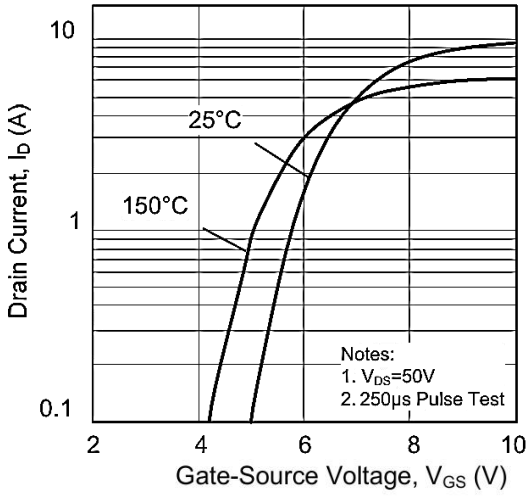
On-Resistance Junction Temperature



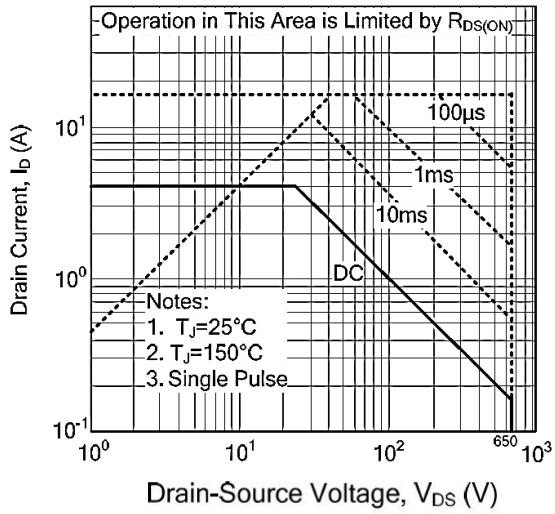
On-State Characteristics



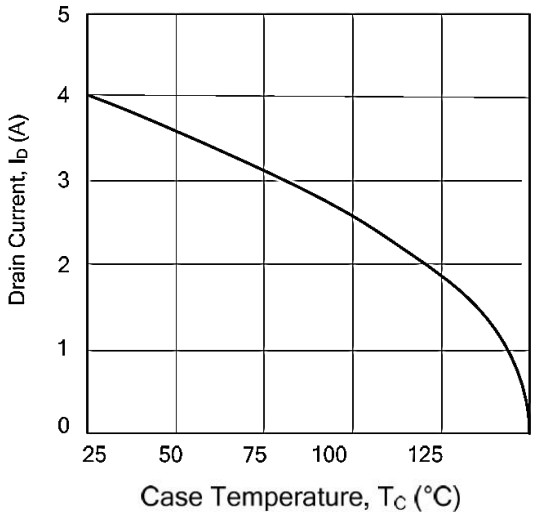
Transfer Characteristics



Safe Operating Area

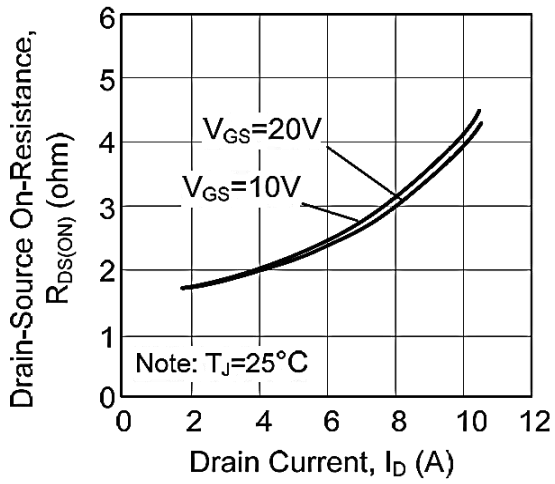


Maximum Drain Current vs. Case Temperature

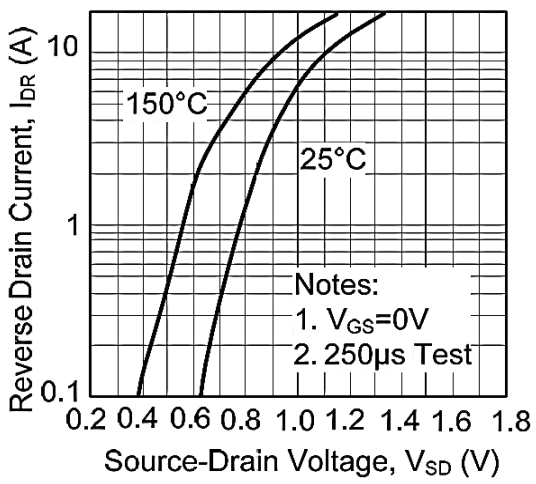


■ TYPICAL CHARACTERISTICS(Con.t)

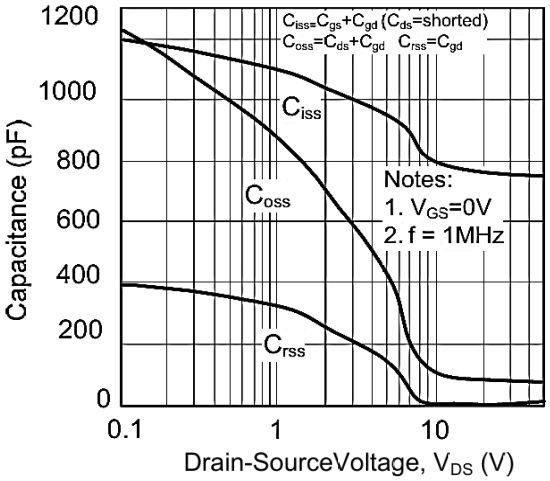
On-Resistance Variation vs. Drain Current and Gate Voltage



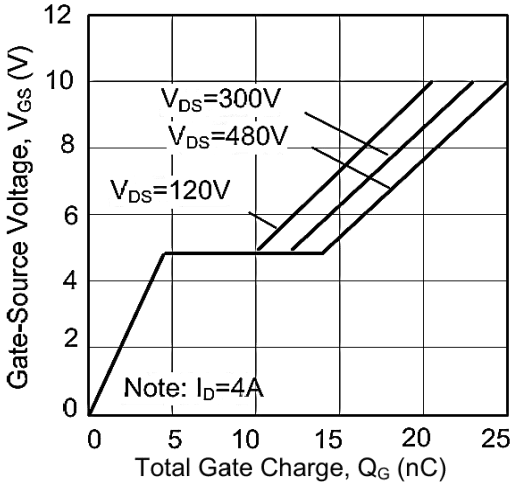
On State Current vs. Allowable Case Temperature



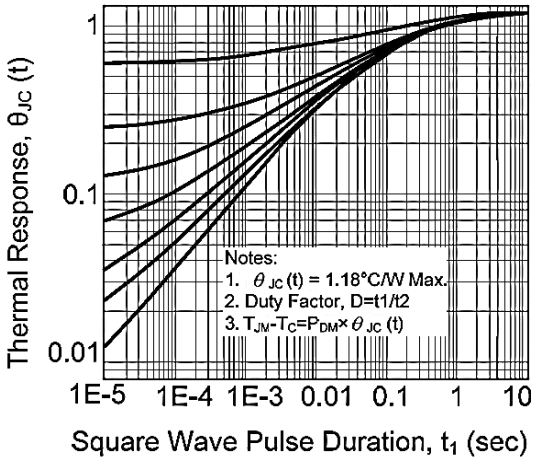
Capacitance Characteristics (Non-Repetitive)



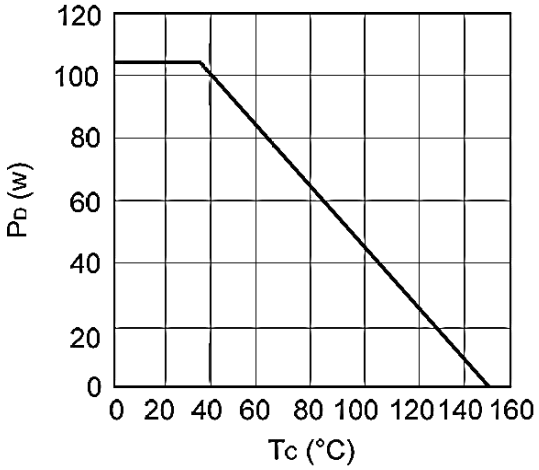
Gate Charge Characteristics



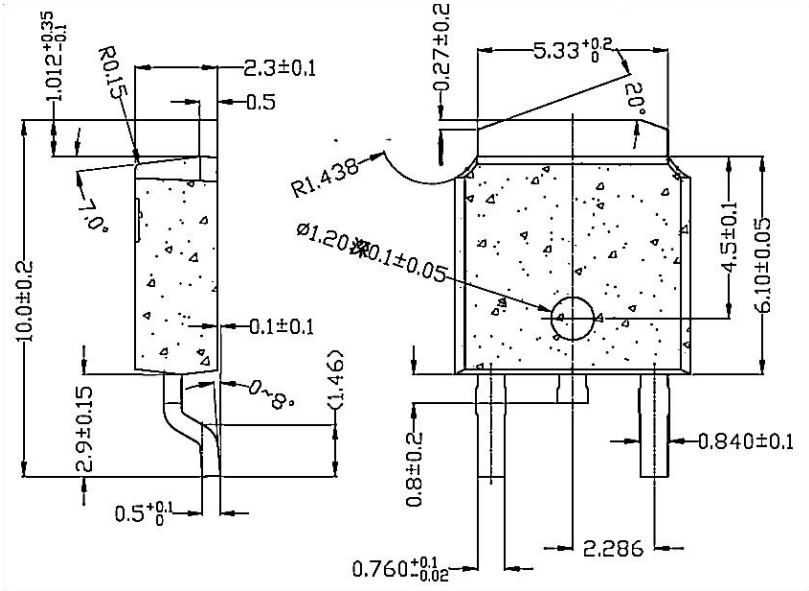
Transient Thermal Response Curve

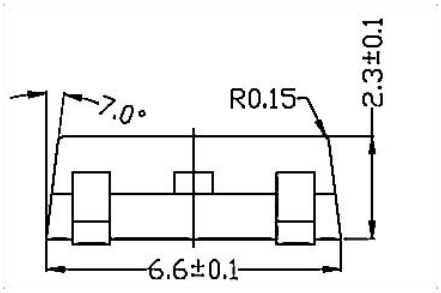


Power Dissipation



■ TO - 252 PACKAGE OUTLINE DIMENSIONS





■ TO - 252 PACKING INFORMATION

Package version	Reel dimensions Φ×H (mm)	Per Reel (pcs)	Reels per box	Inner box dimensions L×W×H(mm)	Outer box (pcs)	Outer box dimensions L×W×H (mm)
TO-252	Φ330*20	2500	2	360*340*50	25000	375*375*280