PerFET™ Power Transistor

FEATURES

- Ultra-low On-resistance
- 100% UIS and Rg tested
- RoHS Compliant
- Halogen-Free according to IEC 61249-2-21
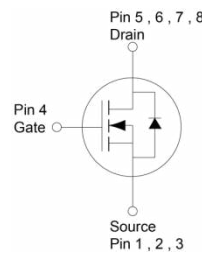
APPLICATIONS

- DC-DC Converters
- Solenoid and Motor Drivers
- Load Switch

PRODUCT SUMMARY		VALUE	UNIT
PARAMETER		VALUE	UNIT
V_{DS}		40	V
$R_{DS(on)}$ (max)	V_{GS} = 10V	7	mΩ
	V_{GS} = 4.5V	9.8	
Q_g	V_{GS} = 4.5V	11	nC

Pb-Free RoHS COMPLIANT HALOGEN FREE

PDFN33

Pin 5 , 6 , 7 , 8
Drain

Pin 4
Gate

Source
Pin 1 , 2 , 3

Note: MSL 1 (Moisture Sensitivity Level) per J-STD-020

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

PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		V_{DS}	40	V
Gate-Source Voltage		V_{GS}	±16	V
Continuous Drain Current, Silicon limited	T_C = 25°C	I_D	55	A
Continuous Drain Current (Note 1)	T_C = 25°C	I_D	54	A
	T_C = 100°C		35	
	T_A = 25°C		14	
Pulsed Drain Current		I_{DM}	216	A
Single Pulse Avalanche Current (Note 2)		I_{AS}	17	A
Single Pulse Avalanche Energy (Note 2)		E_{AS}	43.2	mJ
Total Power Dissipation	T_C = 25°C	P_D	36	W
	T_C = 125°C		7.1	
Operating Junction and Storage Temperature Range		T_J, T_{STG}	-55 to +150	°C

THERMAL RESISTANCE

PARAMETER	SYMBOL	MAXIMUM	UNIT
Thermal Resistance – Junction to Case	$R_{\Theta JC}$	3.5	°C/W
Thermal Resistance – Junction to Ambient	$R_{\Theta JA}$	53	°C/W

Note: $R_{\Theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistances. The case-thermal reference is defined at the solder mounting surface of the drain pins. $R_{\Theta JC}$ is guaranteed by design while $R_{\Theta CA}$ is determined by the user's board design.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNIT
Static						
Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 1mA	BV_{DSS}	40	--	--	V
Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250µA	$V_{GS(TH)}$	1.4	1.8	2.2	V
Gate-Source Leakage Current	V_{GS} = ±16V, V_{DS} = 0V	I_{GSS}	--	--	±100	nA
Drain-Source Leakage Current	V_{GS} = 0V, V_{DS} = 40V	I_{DSS}	--	--	1	µA
	V_{GS} = 0V, V_{DS} = 40V T_J = 125°C		--	--	100	
Drain-Source On-State Resistance (Note 3)	V_{GS} = 10V, I_D = 27A	$R_{DS(on)}$	--	5.9	7	mΩ
	V_{GS} = 4.5V, I_D = 27A		--	7.7	9.8	
Forward Transconductance (Note 3)	V_{DS} = 10V, I_D = 7A	g_{fs}	--	47	--	S
Dynamic						
Total Gate Charge	V_{GS} = 4.5V, V_{DS} = 20V, I_D = 14A	Q_g	--	11	--	nC
Total Gate Charge	V_{GS} = 10V, V_{DS} = 20V, I_D = 14A	Q_g	--	24	--	
Gate-Source Charge		Q_{gs}	--	4.5	--	
Gate-Drain Charge		Q_{gd}	--	3.9	--	
Input Capacitance	V_{GS} = 0V, V_{DS} = 25V, f = 1.0MHz	C_{iss}	--	1376	--	pF
Output Capacitance		C_{oss}	--	249	--	
Reverse Transfer Capacitance		C_{rss}	--	34	--	
Gate Resistance	f = 1.0MHz	R_g	--	1.6	--	Ω
Switching (Note 4)						
Turn-On Delay Time	V_{GS} = 10V, V_{DS} = 20V, I_D = 16A, R_G = 1.6Ω	$t_{d(on)}$	--	8.9	--	nS
Rise Time		t_r	--	48	--	
Turn-Off Delay Time		$t_{d(off)}$	--	28	--	
Fall Time		t_f	--	7.1	--	
Source-Drain Diode						
Diode Forward Voltage (Note 3)	V_{GS} = 0V, I_S = 27A	V_{SD}	--	--	1.1	V
Reverse Recovery Time	I_S = 14A, di/dt = 100A/µs	t_{rr}	--	34	--	nS
Reverse Recovery Charge		Q_{rr}	--	30	--	nC

Notes:

1. Package current limit.
2. L = 0.3mH, V_{GS} = 10V, R_G = 25Ω, Starting T_J = 25°C.
3. Pulse test: Pulse Width ≤ 300µs, duty cycle ≤ 2%.
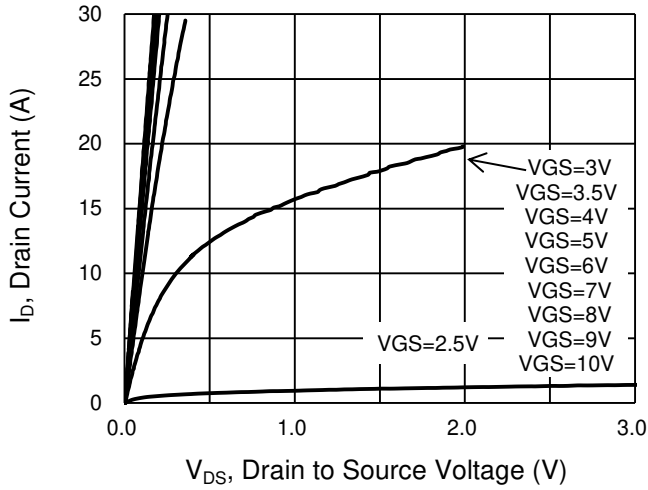4. Switching time is essentially independent of operating temperature.

ORDERING INFORMATION

ORDERING CODE	PACKAGE	PACKING
TSM070NH04LCV RGG	PDFN33	5,000pcs / 13" Reel

Version: A2207

CHARACTERISTICS CURVES

(T_A = 25°C unless otherwise noted)

Output Characteristics

VGS=3V
VGS=3.5V
VGS=4V
VGS=5V
VGS=6V
VGS=7V
VGS=8V
VGS=9V
VGS=10V

VGS=2.5V

I_D, Drain Current (A)

V_{DS}, Drain to Source Voltage (V)

Transfer Characteristics

125°C
25°C
-55°C

I_D, Drain Current (A)

V_{GS}, Gate to Source Voltage (V)
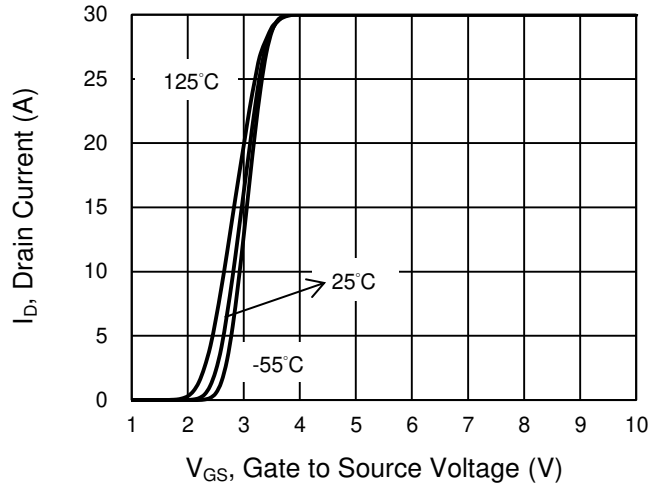
On-Resistance vs. Drain Current

V_{GS}= 4.5V
V_{GS}= 10V

$R_{DS(on)}$, Drain-Source On-Resistance (mΩ)

I_D, Drain Current (A)
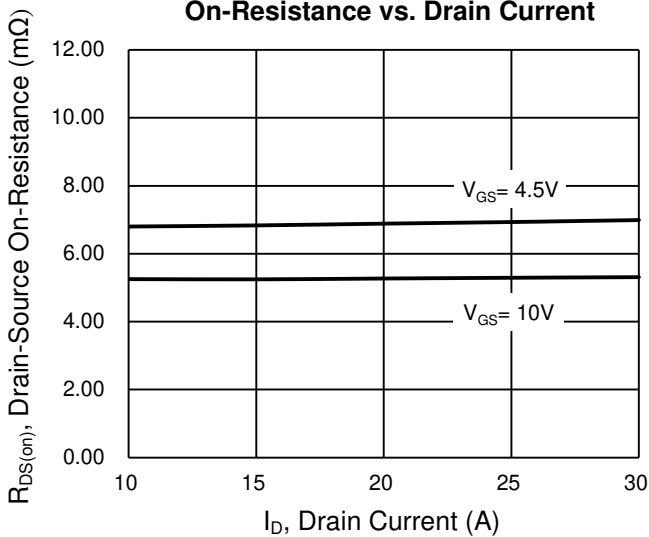
Gate-Source Voltage vs. Gate Charge

V_{DS}=20V
I_D=14A

V_{GS}, Gate to Source Voltage (V)

Q_g, Gate Charge (nC)
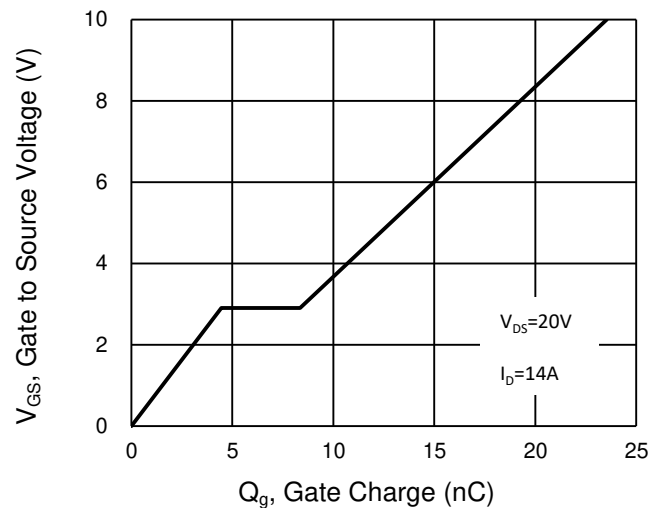
On-Resistance vs. Junction Temperature

V_{GS}=10V
I_D=27A

$R_{DS(on)}$, Drain-Source On-Resistance (Normalized)

T_J, Junction Temperature (°C)
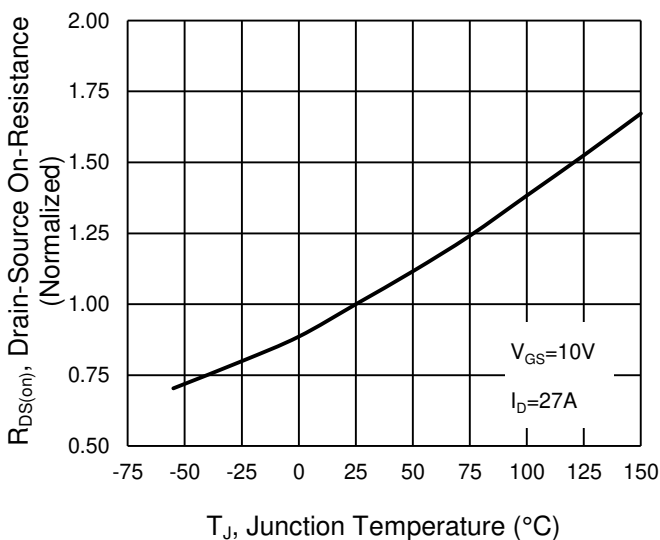
On-Resistance vs. Gate-Source Voltage

I_D=27A

$R_{DS(on)}$, Drain-Source On-Resistance (mΩ)

V_{GS}, Gate to Source Voltage (V)
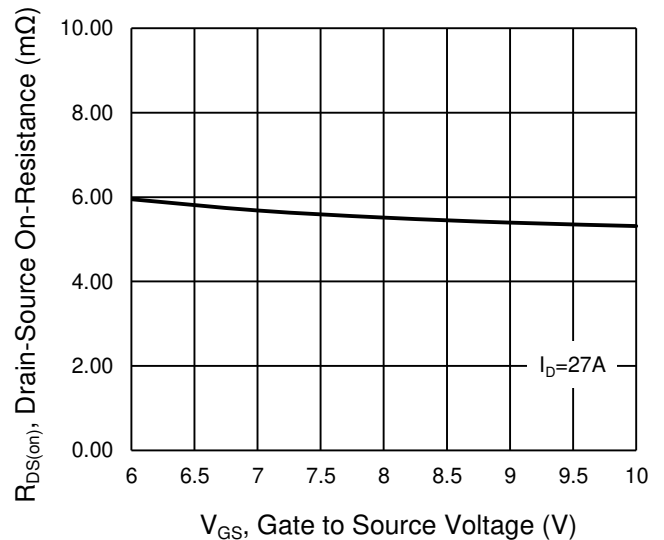
CHARACTERISTICS CURVES

(T_A = 25°C unless otherwise noted)

Capacitance vs. Drain-Source Voltage

C, Capacitance (pF) vs. V_{DS}, Drain to Source Voltage (V)

Ciss, Coss, Crss

V_{GS} = 0V
f = 1MHz

BV$_{DSS}$ vs. Junction Temperature

BV$_{DSS}$ (Normalized) Drain-Source Breakdown Voltage vs. T_J, Junction Temperature (°C)

I_D=1mA
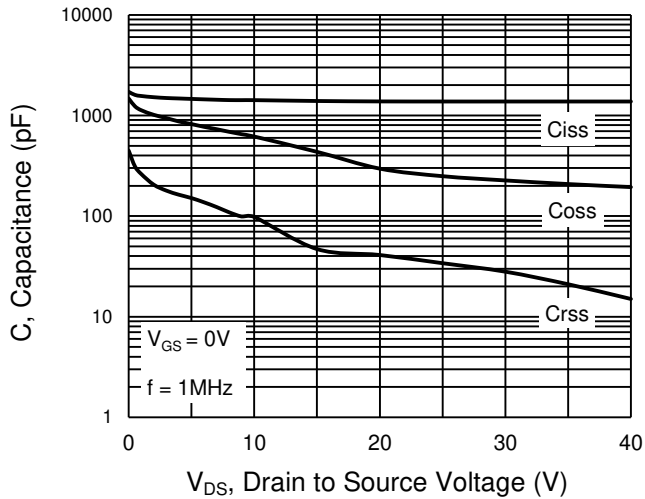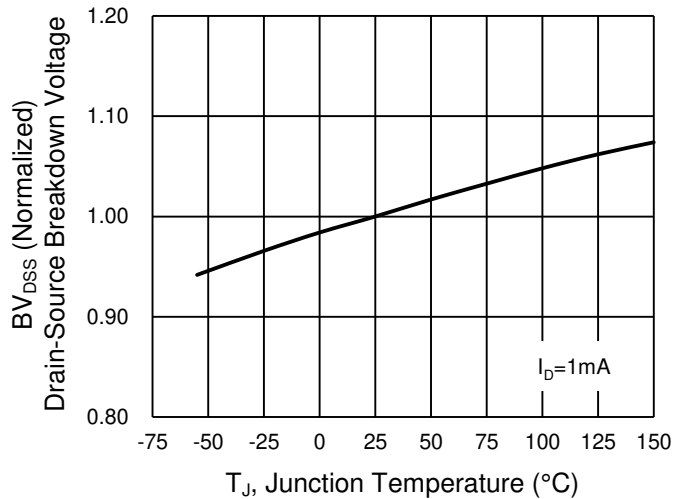
Maximum Safe Operating Area, Junction-to-Case

I_D, Drain Current (A) vs. V_{DS}, Drain to Source Voltage (V)

$R_{DS(ON)}$

100us
1ms
10ms
DC

SINGLE PULSE
$R_{\theta JC}$=3.5°C/W
T_C=25°C
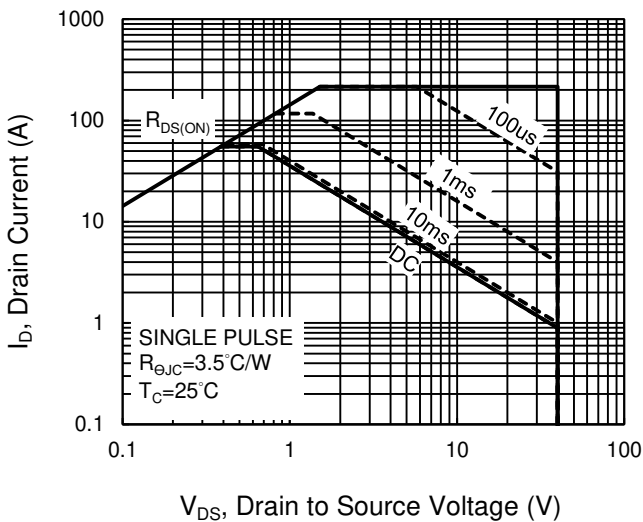
Source-Drain Diode Forward Current vs. Voltage

I_S, Reverse Drain Current (A) vs. V_{SD}, Body Diode Forward Voltage (V)

150°C   25°C   -55°C
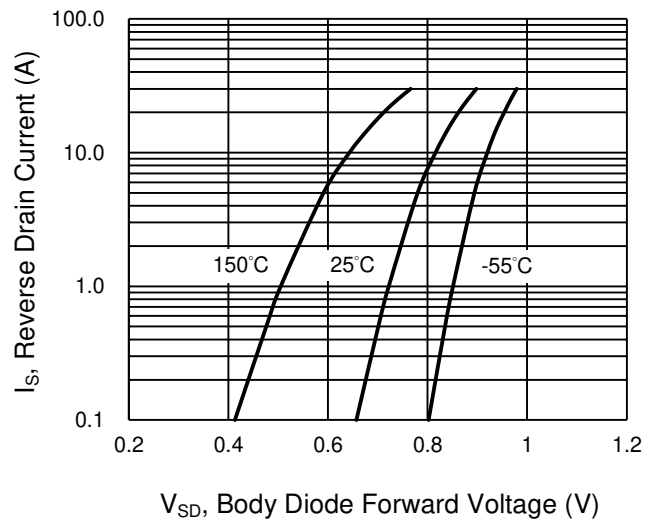
Normalized Thermal Transient Impedance, Junction-to-Case

Normalized Effective Transient Thermal Impedance, $Z_{\theta JC}$ vs. t, Square Wave Pulse Duration (sec)

SINGLE PULSE
$R_{\theta JC}$=3.5°C/W

Duty=0.5
Duty=0.2
Duty=0.1
Duty=0.05
Duty=0.02
Duty=0.01
Single

Notes:
Duty = t_1 / t_2
$T_J = T_C + P_{DM} \times Z_{\theta JC} \times R_{\theta JC}$
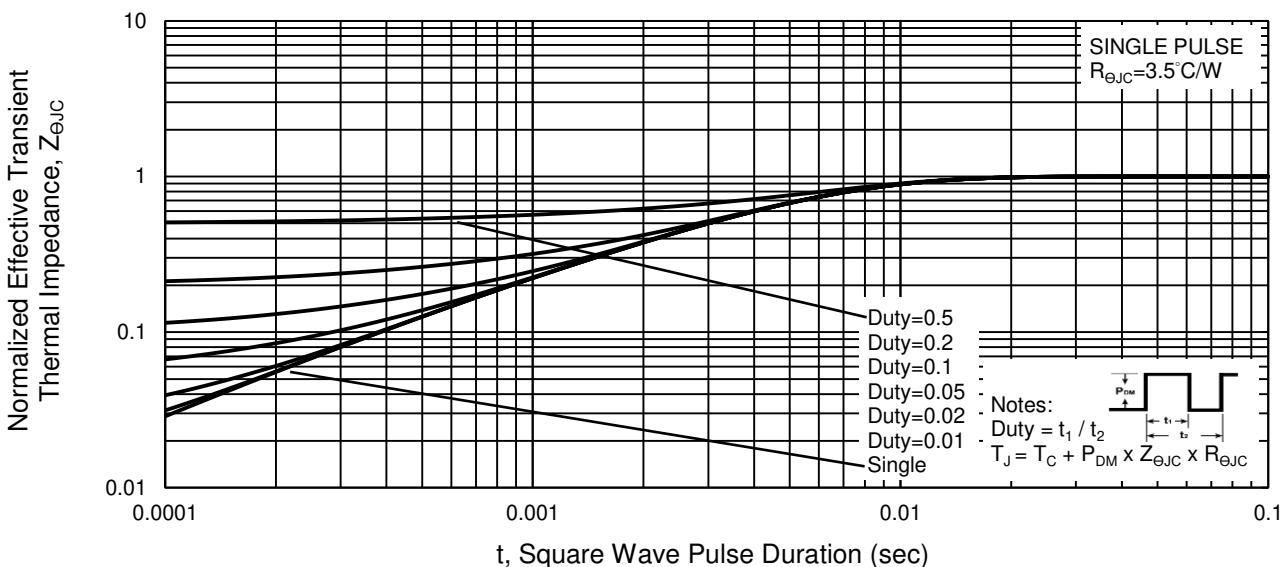
CHARACTERISTICS CURVES

(T_A = 25°C unless otherwise noted)

Power Dissipation

X-axis: Junction-to-Case Temperature (°C), range 0 to 150
Y-axis: P_{TOT} – Power (W), range 0.0 to 40.0

Drain Current

X-axis: Junction-to-Case Temperature (°C), range 0 to 150
Y-axis: I_D, Drain Current (A), range 0 to 70
Silicon limited
V_{GS}=10V
Package limited
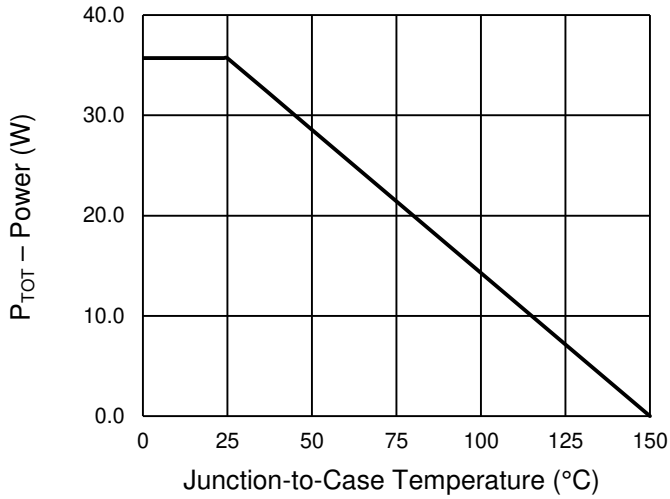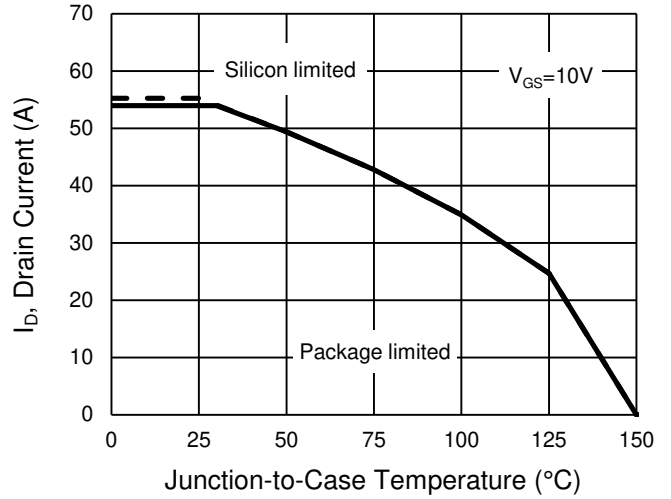
Normalized gate threshold voltage vs Temperature

X-axis: T_J, Junction Temperature (°C), range -75 to 150
Y-axis: Threshold Voltage (Normalized), range 0.0 to 1.6
I_D=250µA
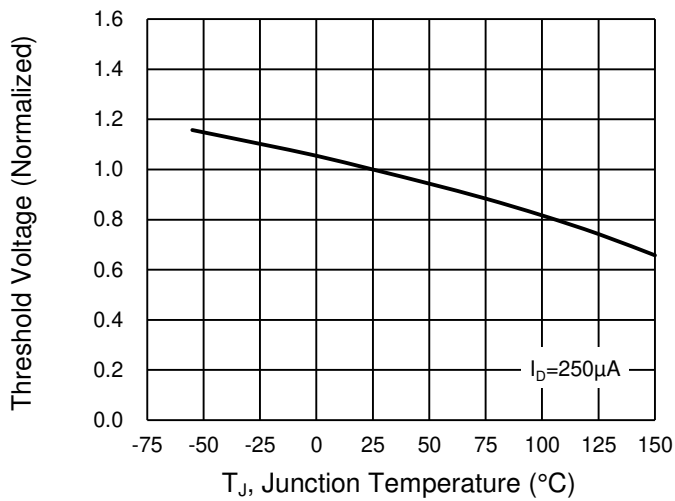
PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

PDFN33

0.13 (NOM.)

0.13 (NOM.)

0.15 (MAX.)

3.35 ±0.10

3.10 ±0.10

#1

0.65 (BSC)

2.49 ±0.10

1.58 ±0.10

0.39 $^{+0.11}_{-0.09}$

0.30 ±0.05   #1

0.40 ±0.10

0.15 $^{+0.10}_{-0.05}$

10°~12°

0.75 ±0.05

3.15 $^{+0.05}_{-0.15}$

3.30 $^{+0.10}_{-0.30}$
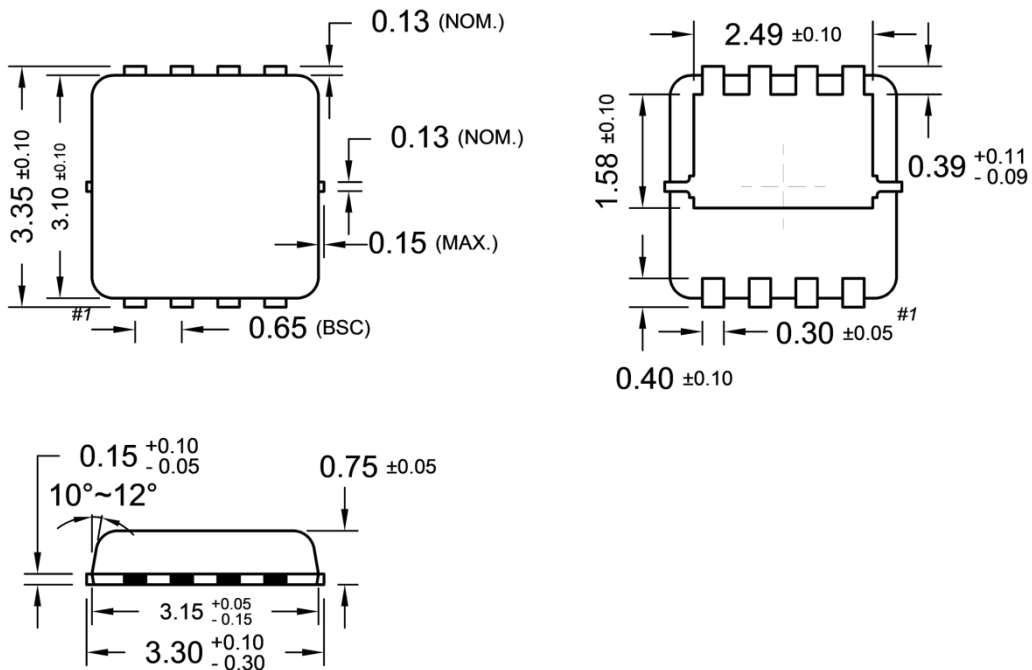
SUGGESTED PAD LAYOUT (Unit: Millimeters)

0.25

2.80

3.55

2.35

0.60

0.40   0.65

0.35

MARKING DIAGRAM

070NH4L
YWWLF

#1
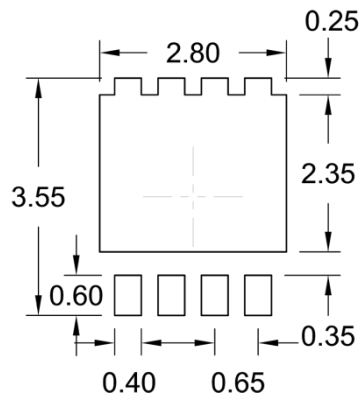
Y	= Year Code
WW	= Week Code (01~52)
L	= Lot Code (1~9,A~Z)
F	= Factory Code

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