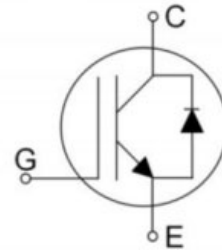
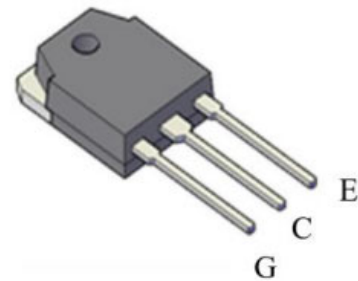


FEATURES

- High breakdown voltage up to 650V for improved reliability
- Trench-Stop Technology offering :
 - High speed switching
 - High ruggedness, temperature stable
 - Low V_{CEsat}
 - Easy parallel switching capability due to positive temperature coefficient in V_{CEsat}
- Enhanced avalanche capability

V_{CE}	650	V
I_C	45	A
$V_{CE(SAT)} \quad I_C=45A$	1.85	V



APPLICATION

- Uninterruptible Power Supplies
- Inverter
- Welding Converters
- PFC applications
- Converter with high switching frequency

Product	Package	Packaging
YGD45N65U1	TO-3P	Tube

Maximum Ratings ($T_j = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Value	Unit
Collector-Emitter Breakdown Voltage, $T_j \geq 25^\circ\text{C}$	V_{CE}	650	V
DC collector current, limited by T_{jmax} $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	I_C	90 45	A
Diode Forward current, limited by T_{jmax} $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	I_F	90 45	A
Continuous Gate-emitter voltage	V_{GE}	± 20	V
Transient Gate-emitter voltage ($t_p \leq 10\mu\text{s}, D < 0.01$)	V_{GE}	± 30	V
Turn off safe operating area $V_{CE} \leq 650\text{V}, T_j \leq 175^\circ\text{C}, t_p = 1\mu\text{s}$	-	135	A
Pulse collector current, $V_{GE} = 15\text{V}$, t_p limited by T_{jmax}	I_{CM}	135	A
Diode Pulsed Current, t_p limited by T_{jmax}	I_{Fpuls}	135	A
Power dissipation, $T_j = 25^\circ\text{C}$	P_{tot}	166	W
Operating junction temperature	T_j	$-40 \dots +175$	$^\circ\text{C}$
Storage temperature	T_s	$-55 \dots +150$	$^\circ\text{C}$
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s	-	260	$^\circ\text{C}$
Mounting torque, M3 screw Maximum of mounting processes: 3	M	0.6	Nm

Thermal Resistance

Parameter	Symbol	Max. Value	Unit
IGBT thermal resistance, junction - case	$R_{\theta(j-c)}$	0.90	K/W
Diode thermal resistance, junction - case	$R_{\theta(j-c)}$	1.30	K/W
Thermal resistance, junction - ambient	$R_{\theta(j-a)}$	46	K/W

Electrical Characteristics (T_j = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Static						
Collector-Emitter Breakdown Voltage	BV _{CES} ^①	V _{GE} =0V, I _C =250μA	650	-	-	V
Gate Threshold Voltage	V _{GE(th)}	V _{GE} =V _{CE} , I _C =250μA	4.00	4.90	5.60	V
Collector-Emitter Saturation Voltage	V _{CE(sat)}	V _{GE} =15V, I _C =45A T _j = 25°C T _j = 175°C	- -	1.85 2.70	-	V
Zero gate voltage collector current	I _{CES}	V _{CE} = 650V, V _{GE} = 0V T _j = 25°C T _j = 175°C	- -	-	40 4000	μA
Gate-emitter leakage current	I _{GES}	V _{CE} = 0V, V _{GE} = ±20V	-	-	400	nA
Transconductance	g _{fs}	V _{CE} = 20V, I _C = 45A	-	22	-	S
Diode Forward Voltage	V _{FM}	I _F = 45A	-	1.90		V

Note:

- ① BV_{CES} testing without filter could damage the device. BV_{CES} is guaranteed by I_{CES}@650V test.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Dynamic						
Input capacitance	C _{ies}	V _{CE} = 30V, V _{GE} = 0V, f = 1MHz	-	2190	-	pF
Output capacitance	C _{oes}		-	98	-	
Reverse transfer capacitance	C _{res}		-	38	-	
Gate charge	Q _G	V _{CC} = 520V, I _C = 45A, V _{GE} = 15V	-	85	-	nC

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Dynamic T_j=25°C						
Turn-on Delay Time	t _{d(on)}	V _{CC} = 400V, I _C = 45A, V _{GE} = 0/15V, R _g =20Ω	-	48	-	ns
Rise Time	t _r		-	85	-	ns
Turn-off Delay Time	t _{d(off)}		-	129	-	ns
Fall Time	t _f		-	80	-	ns
Turn-on Energy	E _{on}		-	2.20	-	mJ
Turn-off Energy	E _{off}		-	0.48	-	mJ

Fig. 1 Saturation voltage characteristics

$$I_C = f(V_{CE})$$

$$V_{GE} = 15V$$

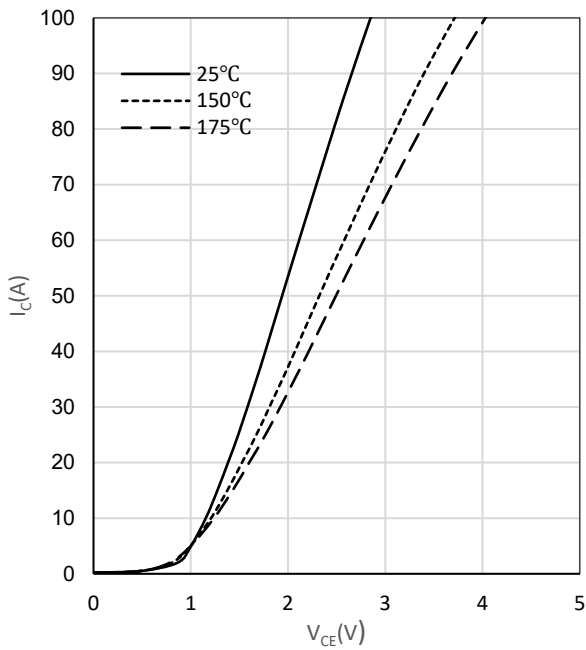


Fig. 2 Output characteristics

$$I_C = f(V_{CE})$$

$$T_J = 25^\circ C$$

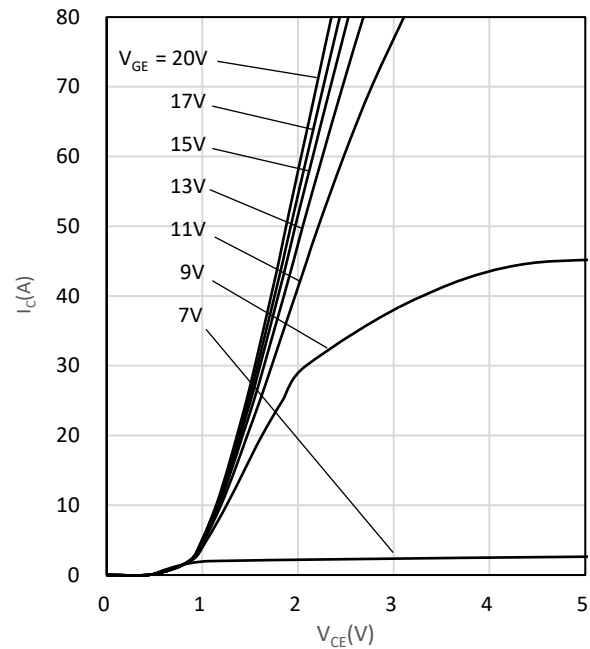


Fig. 3 Switching losses IGBT

$$E_{on} = f(I_C), E_{off} = f(I_C)$$

$$V_{GE} = 0-15V, R_G = 20\Omega, V_{CE} = 400V, T_J = 25^\circ C$$

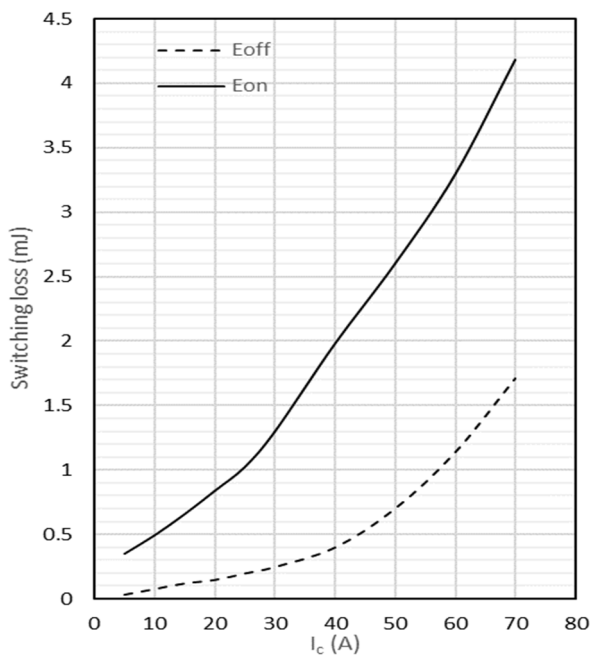


Fig. 4 Switching losses IGBT

$$E_{on} = f(R_G), E_{off} = f(R_G)$$

$$V_{GE} = 0-15V, I_C = 45A, V_{CE} = 400V, T_J = 25^\circ C$$

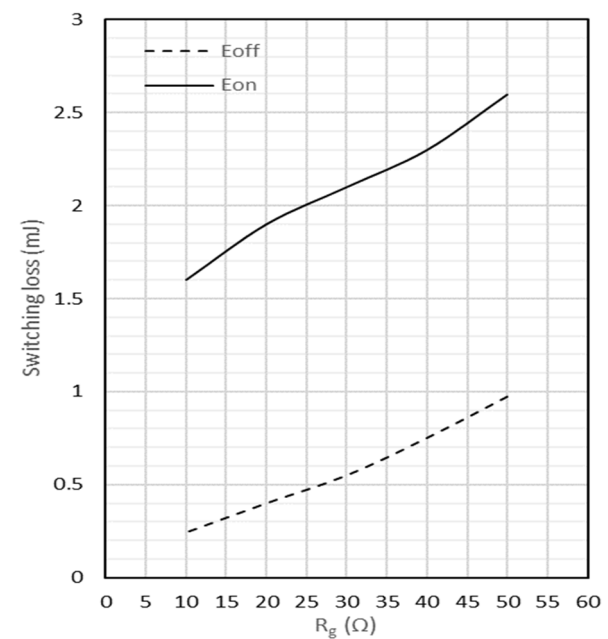


Fig. 5 Switching times IGBT

$T_{don}=f(I_C)$, $T_r=f(I_C)$, $T_{doff}=f(I_C)$, $T_f=f(I_C)$
 $V_{GE}=0-15V$, $R_G=20\Omega$, $V_{CE}=400V$, $T_J=25^\circ C$

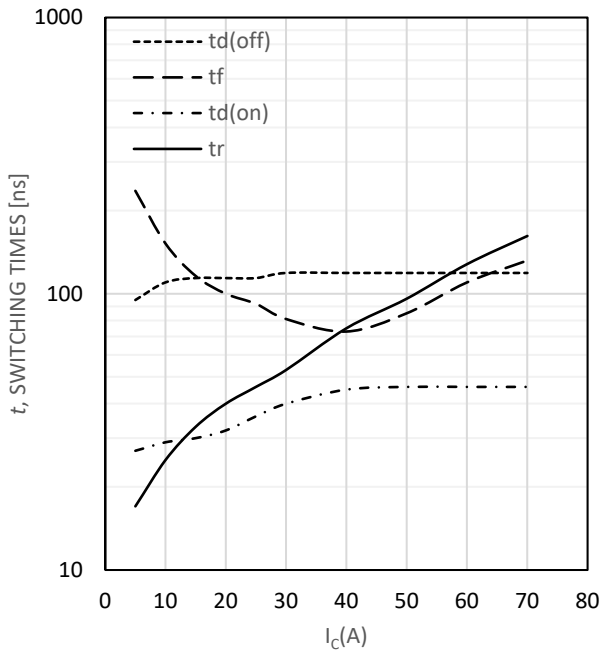


Fig. 6 Switching times IGBT

$T_{don}=f(R_G)$, $T_r=f(R_G)$, $T_{doff}=f(R_G)$, $T_f=f(R_G)$
 $V_{GE}=0-15V$, $I_C=45A$, $V_{CE}=400V$, $T_J=25^\circ C$

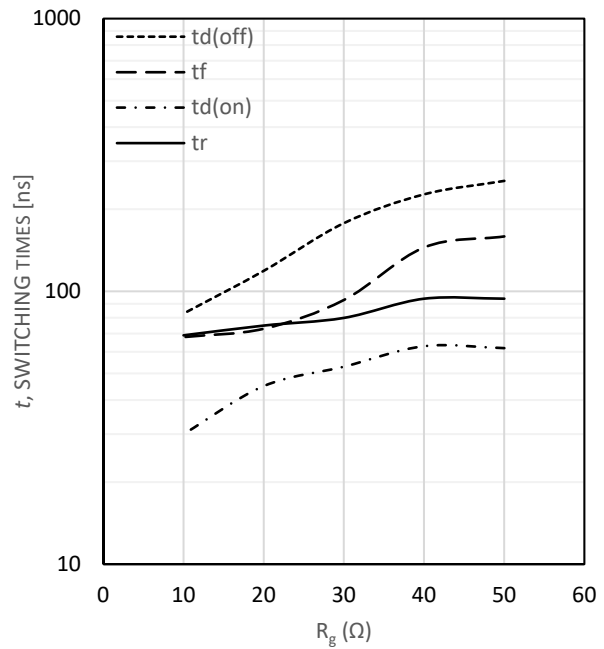


Fig. 7 Gate charge characteristics

$V_{GE}=f(Q_g)$
 $I_C=45A$, $T_J=25^\circ C$

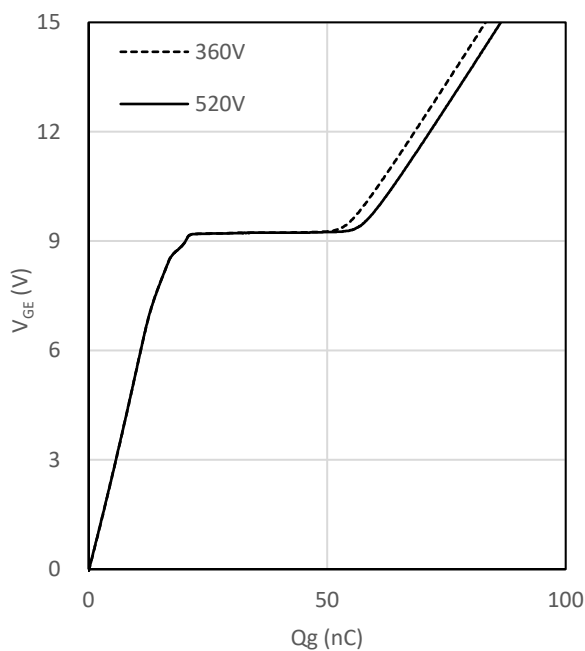
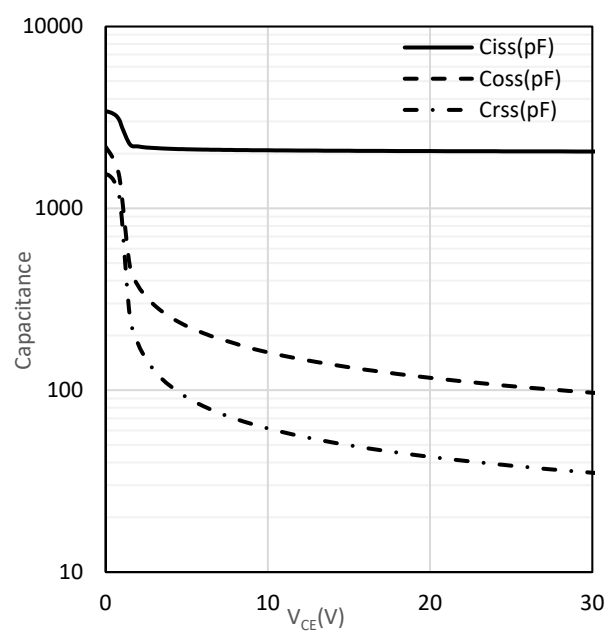
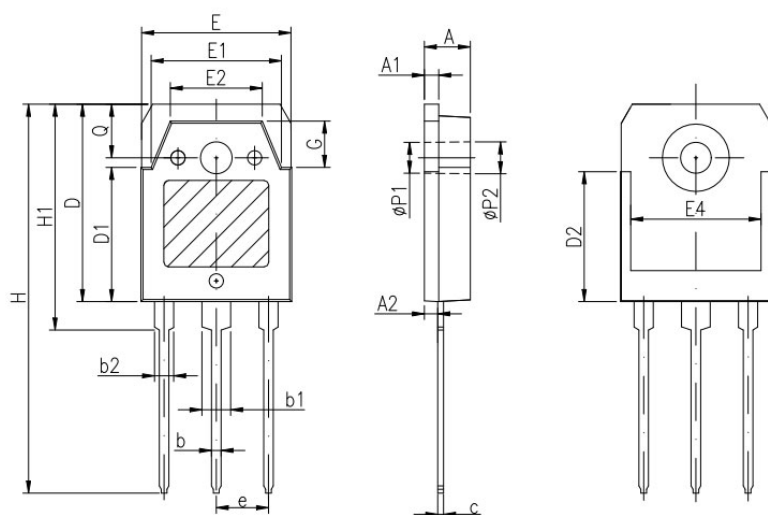


Fig. 8 Capacitance

$C_{ies}=f(V_{CE})$, $C_{oes}=f(V_{CE})$, $C_{res}=f(V_{CE})$
 $T_J=25^\circ C$



TO-3P package information



COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	4.60	4.80	5.00
A1	1.40	1.50	1.65
A2	1.18	1.38	1.58
b	0.80	1.00	1.20
b1	2.80	3.00	3.20
b2	1.80	2.00	2.20
c	0.50	0.60	0.75
D	19.60	19.90	20.20
D1	13.55	13.90	14.25
D2		12.90	REF
E	15.35	15.60	15.85
E1	13.40	13.60	13.80
E2	9.40	9.60	9.80
E4	12.60	-	-
e		5.45	TYP
G	4.55	4.80	5.05
H	40.10	40.50	40.90
H1	23.15	23.40	23.65
$\phi P1$	3.03	3.20	3.37
$\phi P2$	3.30	3.50	3.70
Q		5.00	REF

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