

## High speed switching series fifth generation

## Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage, $T_{vj} \geq 25^{\circ}\text{C}$	$V_{CE}$	650	V
DC collector current, limited by $T_{vjmax}$ $T_c = 25^{\circ}\text{C}$ $T_c = 100^{\circ}\text{C}$	$I_C$	55.0 35.0	A
Pulsed collector current, $t_p$ limited by $T_{vjmax}^{1)}$	$I_{Cpuls}$	90.0	A
Turn off safe operating area $V_{CE} \leq 650\text{V}$ , $T_{vj} \leq 175^{\circ}\text{C}$ , $t_p = 1\mu\text{s}^{1)}$	-	90.0	A
Gate-emitter voltage Transient Gate-emitter voltage ( $t_p \leq 10\mu\text{s}$ , $D < 0.010$ )	$V_{GE}$	$\pm 20$ $\pm 30$	V
Power dissipation $T_c = 25^{\circ}\text{C}$ Power dissipation $T_c = 100^{\circ}\text{C}$	$P_{tot}$	188.0 93.0	W
Operating junction temperature	$T_{vj}$	-40...+175	$^{\circ}\text{C}$
Storage temperature	$T_{stg}$	-55...+150	$^{\circ}\text{C}$
Soldering temperature, reflow soldering (MSL1 according to JEDEC J-STA-020)		260	$^{\circ}\text{C}$

## Thermal Resistance

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b><math>R_{th}</math> Characteristics</b>						
IGBT thermal resistance, junction - case	$R_{th(j-c)}$		-	-	0.80	K/W
Thermal resistance, min. footprint junction - ambient	$R_{th(j-a)}$		-	-	65	K/W
Thermal resistance, 6cm <sup>2</sup> Cu on PCB junction - ambient	$R_{th(j-a)}$		-	-	40	K/W

Electrical Characteristic, at  $T_{vj} = 25^{\circ}\text{C}$ , unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>Static Characteristic</b>						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0\text{V}$ , $I_C = 0.20\text{mA}$	650	-	-	V
Collector-emitter saturation voltage	$V_{CEsat}$	$V_{GE} = 15.0\text{V}$ , $I_C = 30.0\text{A}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	-	1.65	2.10	V
			-	1.85	-	
			-	1.95	-	
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C = 0.30\text{mA}$ , $V_{CE} = V_{GE}$	3.2	4.0	4.8	V
Zero gate voltage collector current	$I_{CES}$	$V_{CE} = 650\text{V}$ , $V_{GE} = 0\text{V}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	-	-	40	$\mu\text{A}$
			-	1000	-	
Gate-emitter leakage current	$I_{GES}$	$V_{CE} = 0\text{V}$ , $V_{GE} = 20\text{V}$	-	-	100	nA
Transconductance	$g_{fs}$	$V_{CE} = 20\text{V}$ , $I_C = 30.0\text{A}$	-	30.0	-	S

<sup>1)</sup> Defined by design. Not subject to production test.

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Electrical Characteristic, at  $T_{vj} = 25^{\circ}\text{C}$ , unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>Dynamic Characteristic</b>						
Input capacitance	$C_{ies}$	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$	-	1800	-	pF
Output capacitance	$C_{oes}$		-	50	-	
Reverse transfer capacitance	$C_{res}$		-	10	-	
Gate charge	$Q_G$	$V_{CC} = 520\text{V}, I_C = 30.0\text{A}, V_{GE} = 15\text{V}$	-	70.0	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	$L_E$		-	7.0	-	nH

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit	
			min.	typ.	max.		
<b>IGBT Characteristic, at <math>T_{vj} = 25^{\circ}\text{C}</math></b>							
Turn-on delay time	$t_{d(on)}$	$T_{vj} = 25^{\circ}\text{C}, V_{CC} = 400\text{V}, I_C = 15.0\text{A}, V_{GE} = 0.0/15.0\text{V}, R_{G(on)} = 23.0\Omega, R_{G(off)} = 23.0\Omega, L\sigma = 30\text{nH}, C\sigma = 30\text{pF}$ Energy losses include "tail" and diode reverse recovery.	-	24	-	ns	
Rise time	$t_r$		-	15	-	ns	
Turn-off delay time	$t_{d(off)}$		-	184	-	ns	
Fall time	$t_f$		-	24	-	ns	
Turn-on energy	$E_{on}$		-	0.32	-	mJ	
Turn-off energy	$E_{off}$		-	0.09	-	mJ	
Total switching energy	$E_{ts}$		-	0.41	-	mJ	
Turn-on delay time	$t_{d(on)}$		$T_{vj} = 25^{\circ}\text{C}, V_{CC} = 400\text{V}, I_C = 5.0\text{A}, V_{GE} = 0.0/15.0\text{V}, R_{G(on)} = 23.0\Omega, R_{G(off)} = 23.0\Omega, L\sigma = 30\text{nH}, C\sigma = 30\text{pF}$ Energy losses include "tail" and diode reverse recovery.	-	22	-	ns
Rise time	$t_r$			-	8	-	ns
Turn-off delay time	$t_{d(off)}$	-		188	-	ns	
Fall time	$t_f$	-		27	-	ns	
Turn-on energy	$E_{on}$	-		0.11	-	mJ	
Turn-off energy	$E_{off}$	-		0.03	-	mJ	
Total switching energy	$E_{ts}$	-		0.14	-	mJ	